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APPENDIX TO THE JOURNALS

OF THE

SENATE AND ASSEMBLY

OF THE

THIRTY-FIFTH SESSION

OF THE

LEGISLATURE OF THE STATE OF CALIFORNIA.

VOLUME III.

SACRAMENTO:
W. W. SHANNON, : : : : SUPERINTENDENT STATE PRINTING.
1903.

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2—Transactions of the State Agricultural Society. 1901.

3—Official Report of Twenty-sixth Fruit-Growers' Convention. 1901.

4—Eighth Biennial Report of the State Board of Horticulture. 1901–1902.

5—Annual Report of Insurance Commissioner. 1900.

6—Report of Work of the Agricultural Experiment Station of the University of California. Part I. 1898–1901.

7—Report of Work of the Agricultural Experiment Station of the University of California. Part II. 1898–1901.

8—The Peach-Worm. Bulletin No. 144. Agricultural Experiment Station of the University of California. September, 1902.

TRANSACTIONS

OF THE

CALIFORNIA

STATE AGRICULTURAL SOCIETY

DURING THE YEAR 1900.

SACRAMENTO:
A. J. JOHNSTON, : : : : : : : : SUPERINTENDENT STATE PRINTING.
1901.

STATE BOARD OF AGRICULTURE, 1900.

DIRECTORS.

W. P. MATHEWS	Sacramento.
F. D. COBB	Stockton.
M. D. CHAMBERLIN	Woodland.
GROVE L. JOHNSON	Sacramento.
A. B. SPRECKELS	San Francisco.
F. W. COVEY	Palo Alto.
J. W. WILSON	Sacramento.
PARK HENSHAW	Chico.
FREDERICK COX	Sacramento.
A. W. BARRETT	Los Angeles.
J. E. TERRY	Sacramento.
JOHN MACKEY	Sacramento.

OFFICERS OF THE BOARD.

A. B. SPRECKELS	President.
PETER J. SHIELDS (Post Office, Sacramento.)	Secretary.
J. W. WILSON	Superintendent of Park.
W. P. MATHEWS	Superintendent of Pavilion.

Office of the State Board of Agriculture,
Sacramento, Cal., October 22, 1901.

To the Hon. Henry T. Gage, *Governor of California:*

Sir: As required by law, we submit to you this, the annual report of the transactions of the California State Agricultural Society for the year ending February 1, 1901.

Owing to a vacancy in the office of Secretary for several months prior to July 1, 1901, much of the matter usually contained in our report is omitted. We have included herein and transmit herewith, however, a number of articles upon important agricultural and industrial topics by qualified authorities.

Such necessary statistics and information as are omitted from this report will be incorporated and included in our forthcoming report for the year ending February 1, 1902, which is now in course of preparation.

Very respectfully submitted,

A. B. SPRECKELS,
President.

GEORGE W. JACKSON,
Secretary.

FINANCIAL STATEMENT.

FEBRUARY 1, 1900, TO JANUARY 31, 1901.

SUMMARY.

Receipts.

1900			
Feb. 1	Cash balance	$266 13	
	Rent	2,128 08	
	Bills payable	18,750 36	
	Park and Pavilion receipts	35,068 35	
	Premiums	15,126 00	
	Expense rebates	86 10	
	Races	18,655 00	
	Entrances due, collected	1,800 60	
	Fixed events	3,830 00	
	Collected entrances due other Associations	807 55	
	Bank balance	1,781 46	
			$98,299 63

Disbursements.

	Expense	$27,103 01	
	Races	38,745 00	
	Advertising	2,416 40	
	Salaries	5,336 60	
	Premiums	9,768 95	
	Insurance	553 60	
	Interest	2,834 61	
	Bills payable	4,842 23	
	Entrances due	1,796 67	
	Entrances due other Associations	807 55	
1901			
Feb. 1	Bank balance	2,778 75	
	Cash balance	1,316 26	
			$98,299 63

RECEIPTS.

1900.			
Feb. 1	Bank balance		$1,781 46
	Cash balance		266 13

Races, 1900.

Race 1	The Occident Stake	$300 00	
2	Pacing purse, green class	390 00	
3	Selling purse	70 00	
4	Selling purse	70 00	
5	Selling purse	140 00	
6	Pacing stake, 2:20 class	240 00	
7	Trotting purse, 2:24 class	1,000 00	
8	Flash Stake	480 00	
9	Selling purse	80 00	
10	Selling purse	90 00	
10A	Polo pony race	20 00	
11	Pacing purse, 2:25 class	900 00	
12	Trotting purse, 2:10 class	610 00	
	Amount carried forward	$4,390 00	$2,047 59

Amount brought forward	$4,390 00	$2,047 59
Race 13—Shafter Selling Stake	360 00	
14—Selling purse	80 00	
15—Selling purse	70 00	
16—Pacing purse, 2:11 class	820 00	
17—Trotting purse, 2:15 class	700 00	
18—Dewey Selling Stake	440 00	
19—Selling purse	90 00	
20—Selling purse	100 00	
20A—Polo pony race	20 00	
21—Drummers' race, special		
22—Trotting purse, green class	360 00	
23—Running purse	70 00	
23A—Polo pony race	30 00	
24—Selling purse	90 00	
25—Selling purse	40 00	
26—Pacing purse, 2:15 class	700 00	
27—Trotting purse, 2:19 class	650 00	
28—Vinctor Stake	340 00	
29—Selling purse	60 00	
29A—Selling purse	90 00	
29B—Selling purse	280 00	
30—Stanford Stake	170 00	
31—Trotting purse, 2:12 class	650 00	
32—Selling purse	100 00	
33—Selling purse	90 00	
34—Selling purse	60 00	
35—Pacing purse, 2:18 class	1,150 00	
36—Trotting purse, 2:16 class	300 00	
37—Futurity Stake	635 00	
38—Selling purse	80 00	
39—Selling purse	90 00	
39A—Polo pony race	20 00	
40—Trotting purse, 2:21 class	950 00	
42—Trotting purse, 2:40 class	100 00	
43—Selling purse	60 00	
44—Selling purse	70 00	
45—Selling purse	80 00	
45A—Selling purse	70 00	
46—Sacramento County Roadsters, special		
47—Free-for-all trot	370 00	
48—Sunny Slope Stake	330 00	
49—Capital City Stake	430 00	
50—Free purse		
51—Trotting stake, 2:25 class	185 00	
52—Pacing purse, 2:21 class	390 00	
53—Free purse		
54—Free purse		
55—Free purse		
55A—Free purse		
56—Trotting purse, 2:30 class	700 00	
57—Pacing purse, 2:13 class	700 00	
58—California Annual Stake	310 00	
59—Favorite Stake	535 00	
60—Free purse		
60A—Selling purse	250 00	
		$18,655 00

PARK AND PAVILION RECEIPTS.

1900.			
Sept.	3—Park ticket sales	$612 00	
	4—Park ticket sales	484 00	
	5—Park ticket sales	592 50	
	6—Park ticket sales	634 75	
	7—Park ticket sales	925 00	
	8—Park ticket sales	679 50	
	10—Park ticket sales	938 50	
	11—Park ticket sales	587 25	
	12—Park ticket sales	720 50	
	13—Park ticket sales	1,199 00	
	14—Park ticket sales	765 00	
	15—Park ticket sales	1,860 75	
	Hall, Luhrs & Co., merchants' tickets	9 75	
			$10,008 50
	Amount carried forward		$30,711 09

	Amount brought forward		$30,711 09
Sept.	3—Pavilion ticket sales	$922 00	
	4—Pavilion ticket sales	483 50	
	5—Pavilion ticket sales	457 75	
	6—Pavilion ticket sales	525 50	
	7—Pavilion ticket sales	686 00	
	8—Pavilion ticket sales	766 75	
	10—Pavilion ticket sales	454 50	
	11—Pavilion ticket sales	571 75	
	12—Pavilion ticket sales	627 00	
	13—Pavilion ticket sales	948 75	
	14—Pavilion ticket sales	834 00	
	15—Pavilion ticket sales	1,201 25	
	Hall, Luhrs & Co., merchants' tickets	15 90	
	A. T. Lightner, merchants' tickets	2 50	
	Oak Park Wheelmen, daily tickets	120 00	
	Sacramento Chamber of Commerce	127 50	
	Drummers' Association, merchants' tickets	15 75	
	T. L. Enright, merchants' tickets	75 00	
	S. E. Watson, exhibitors' tickets	215 00	
	Sweepstakes	221 00	
			$9,271 40
	Pool privilege	$12,000 00	
	Auction pools	1,532 50	
	Refreshment privilege	986 50	
	Restaurant privilege	20 50	
	Programme privilege	650 95	
	Manure privilege	150 00	
	Phonograph privilege	10 00	
	Sale of art catalogues	13 00	
	Receipts from dog show	410 00	
	S. E. Watson	15 00	
			$15,788 45

PREMIUMS.

State warrant for premiums and care of buildings	$15,000 00	
Van Camp Packing Co., for medals	12 50	
Duplicate diplomas	3 50	
Felix Dunn, collections	110 00	
		$15,126 00

EXPENSE REBATE.

Sales of forage, etc.	$78 85	
Sale of old lumber	4 00	
American Kennel Club, rebate on membership	3 25	
		$86 10

BILLS PAYABLE.

California State Bank	$213 00	
James Touhey	702 00	
D. O. Mills & Co.	12,000 00	
Central California Electric Co.	235 25	
Sacramento Electric, Gas, and Railway Co.	716 64	
Hale Bros.	165 04	
John Lafferty & Son	112 50	
Capital Gas Co.	268 46	
W. F. Frazer	986 35	
Friend & Terry Lumber Co.	296 40	
J. W. Wilson & Son	205 00	
Grafmiller Bros.	126 48	
Meiss Bros.	194 50	
C. H. Krebs & Co.	161 45	
A. Meister & Son	154 05	
California State Bank	213 00	
John Mackey	250 00	
Brighton Milling Co.	143 64	
A. K. Wackman	192 57	
George Boyne	415 00	
George B. Stack	874 03	
C. W. Hammerton	50 00	
E. P. Heald	15 00	
Vendome Stock Farm	10 00	
Frank Burke	50 00	
		$18,750 36
Amount carried forward		$89,733 40

Amount brought forward		$89,733 40

ENTRANCES DUE, COLLECTED.

Date	Item	Amount	Total
Feb. 7	National Trotting Association on "Charles Newman"	$90 00	
May 30	National Trotting Association on "McBriar"	100 00	
July 30	National Trotting Association on "Teddy the Roan"	85 14	
Aug. 16	National Trotting Association on "Joe Wheeler"	80 41	
31	National Trotting Association on "Rey Direct"	52 50	
Sept. 13	National Trotting Association on "Clipper"	45 50	
20	National Trotting Association an "Altena"	105 00	
	G. Y. Bollinger, races 26 and 40	50 00	
	Owen Bros.	35	
	J. Wheeler on "Apollinaris"	10 00	
	National Trotting Association on "Localer"	50 00	
	National Trotting Association on "Monica"	136 40	
	Tuttle Bros.	95 00	
	W. R. Larzelere	50 00	
	C. Boots	110 00	
	J. Mackey	238 00	
	Tryon & Co.	175 00	
	J. W. Rea	5 00	
	Sundry entrances due	322 30	
			$1,800 60

OTHER ASSOCIATIONS.

Collections made account entrance due other associations		$807 55

RENT.

Item	Amount	Total
Rent of Agricultural Park from John F. Farley	$1,333 33	
Rent of Agricultural Park from James Martin	700 00	
Odd Fellows' drill corps, Pavilion	7 50	
Maccabees' drill corps, Pavilion	8 25	
Charles Tidball, Pavilion	3 00	
Ringling Bros., Park	75 00	
Football team, Pavilion	1 00	
		$2,128 08

FIXED EVENTS.

Item	Amount	Total
Occident Stake, 1901	$565 00	
Occident Stake, 1902	720 00	
Occident Stake, 1903	760 00	
Stanford Stake, 1901	225 00	
Stanford Stake, 1902	610 00	
Futurity Stake, 1901	220 00	
Stallion Stake, 1902	220 00	
Stallion Stake, 1903	160 00	
Stallion Stake, 1902 (foals of 1900)	350 00	
		$3,830 00
		$98,299 63

DISBURSEMENTS.

ADVERTISING.

Date	Item	Amount
Sept. 15	Sonoma County Farmer	$8 00
	Placer Representative	5 00
	Pastime	10 00
	Willows Promoter	5 00
	Nevada City Transcript	10 00
	Davisville Enterprise	5 00
	Amador Dispatch	6 00
	Santa Ana Standard	4 50
	Nord California Herold	7 00
	Antioch Ledger	5 00
	Sacramento Sunday Leader	10 00
	Sacramento Time Table	5 00
	Sacramento Sunday News	12 50
	Sacramento Record-Union	241 25
	Sacramento Bee	210 60
	Amount carried forward	$544 85

1900.	Amount brought forward	$544 85	
Sept. 15—	San Francisco Bulletin	70 00	
	San Francisco Call	175 00	
	San Francisco Chronicle	100 00	
	San Francisco Examiner	143 35	
	San Francisco Evening Post	50 00	
	Pacific Rural Press	50 00	
	Oakland Tribune	60 00	
	Western Creamery	45 00	
	The Monitor	5 00	
	San Leandro Reporter	7 50	
	Ione Echo	5 00	
	Willows Journal	5 00	
	Bakersfield Californian	6 00	
	Nevada City Herald	5 00	
	Oroville Mercury	6 00	
	Vallejo Chronicle	10 00	
	Santa Rosa Republican	10 00	
	Palo Alto Times	7 50	
	Amador Ledger	6 00	
	Placerville Nugget	5 00	
	Marysville Appeal	10 00	
	Newcastle News	5 00	
	Redding Free Press	5 00	
	Santa Cruz Sentinel	5 00	
	Auburn Republican-Argus	5 00	
	Sutter County Farmer	5 00	
	Red Bluff News	7 50	
	Auburn Placer Herald	5 00	
	Dixon Tribune	4 00	
	Modesto News	6 00	
	Chico Record	5 00	
	Butchers & Stock-Growers' Journal	6 00	
	Oroville Register	6 00	
	Redding Searchlight	7 50	
	Downieville Mountain Messenger	6 00	
	Woodland Democrat	8 00	
	Red Bluff Sentinel	7 00	
	Merced Sun	6 00	
	Folsom Telegraph	5 00	
	Lodi Sentinel	5 00	
	Chico Enterprise	6 00	
	Livermore Herald	7 50	
	Winters Express	5 00	
	Placerville Mountain Democrat	5 00	
	Colusa Sun	10 00	
	Stockton Record	10 00	
	Plumas Independent	5 00	
	Grass Valley Telegraph	7 50	
	Napa Journal	5 00	
	Marysville Democrat	5 00	
	Eureka Times	5 00	
	Napa Register	5 00	
	Stockton Independent	15 00	
	California Fruit-Grower	20 00	
	Fresno Democrat	15 00	
	Oakland Enquirer	20 00	
	Los Angeles Herald	20 00	
	San José Herald	15 00	
	San José Mercury	15 00	
	Stockton Mail	15 00	
	Grass Valley Union	15 00	
	Fresno Republican	15 00	
	San José Fanciers' Monthly	15 00	
	Galt Gazette	10 00	
	Crescent City News	5 00	
	Woodland Mail	6 00	
	Petaluma Courier	7 50	
	San Francisco Post	60 00	
	Solano Republican	10 00	
	J. H. Nathan and J. Donnallee, posting bills	300 00	
	Breeder and Sportsman	299 20	
	Sacramento Sunday News	27 50	$2,416 40

	Amount brought forward		$2,416 40

EXPENSE.

1900.			
Feb.	1—National Trotting Association, dues 1900	$100 00	
	7—Wells, Fargo & Co., expressage	85	
	Sunset Telephone and Telegraph Co., 'phone	6 00	
	20—Postoffice money order, exchange	15	
	28—Wells, Fargo & Co., express	37	
Mar.	2—A. McDonald, hauling cinders	2 00	
	P. McGuire, hauling sand	6 00	
	Capital Telephone and Telegraph Co., 'phone for December, January, and February	10 50	
	3—Registering medals by mail	1 15	
	Wells, Fargo & Co., expressage on gold medals	1 15	
	Postage	5 00	
	27—Sunset Telephone and Telegraph Co., 'phone for March	6 65	
	C. Flohr, repairing locks	35	
	28—Mary C. Hinkson, writing diplomas	1 00	
April	3—Charles Studarus, wood	6 75	
	5—Postoffice box rent for June	2 50	
	Postage stamps	5 00	
	10—Insect powder	45	
	13—Sunset Telephone and Telegraph Co., use of 'phone	7 70	
	14—Hevener, Mier & Co., frame for diploma	1 50	
	17—Postage stamps	22 00	
	21—Revenue stamps	10	
	25—W. P. Fuller & Co., paints	36 85	
May	1—Wells, Fargo & Co., express	25	
	Postal cards	6 00	
	3—Wells, Fargo & Co., express	4 90	
	9—Mrs. Higgins, making carnival flag	1 50	
	10—Sunset Telephone and Telegraph Co., use of 'phone	5 75	
	16—Washing towels	25	
	Postage stamps	15 00	
June	4—Capital Telephone and Telegraph Co., 'phone for March, April, and May	10 50	
	Postage stamps	5 00	
	7—Holbrook, Merrill & Stetson, stove	14 60	
	M. H. Dunn, one pair trimming shears	5 00	
	9—Freeport Telephone and Telegraph Co., use of 'phone	1 50	
	Charles Farren, engrossing	50	
	Postal Telegraph Co., delivering message	30	
	Membership in American Kennel Club	10 10	
	J. P. Culverson, repairs at track	21 00	
	W. F. Drew, repairs on lawn mower	2 25	
	S. Fitzgerald, labor at Park	3 00	
	26—D. J. Ellis, drayage	25	
	Postage stamps	5 00	
	27—P. Siebenthaler, labor at Park	2 50	
	Mary C. Hinkson, writing diplomas	2 50	
	30—Wells, Fargo & Co., express	3 60	
July	5—Postoffice box rent	2 50	
	9—Postage	15 00	
	12—Flohr & Magistrini, repairing locks	65	
	13—Postage stamps and cards	12 50	
	14—D. J. Ellis, expressage	25	
	Postage	10 00	
	24—Special delivery stamps	30	
	S. Dwyer, hay and straw	10 25	
	27—Postal cards	1 00	
	28—Expense, Directors' meeting	1 35	
	30—Record-Union, advertising	8 00	
	Postage stamps	5 00	
	Pasteur Filter Co., repairing filter	1 00	
Aug.	2—Postage stamps	5 00	
	Bowers Hose Co., hose	43 75	
	3—Harriet Presley, stenographer	2 00	
	6—Postage stamps	10 00	
	7—Postal cards	5 00	
	8—D. J. Ellis, expressage	50	
	10—Herndon & Haley, brickwork at Park	20 00	
	Postage stamps	15 00	
	Amount carried forward	$514 32	$2,416 40

1900.	Amount brought forward	$514 32	$2,416 40
Aug.	13—Postage stamps	21 00	
	Membership American Kennel Club	25 15	
	Postal Telegraph Co., telegram	65	
	14—Mason's Laundry	25	
	D. Ellis, expressage	50	
	16—Postage stamps	5 00	
	Melvin Gilson, carpenter work	86 20	
	W. F. Purnell, typewriter oil	20	
	18—Postage stamps	5 00	
	23—Postage stamps	5 00	
	24—Transportation for James Cole, kennel judge	50 00	
	Wells, Fargo & Co., express	50	
	27—D. J. Ellis, express	75	
	Postage	10 00	
	30—James Touhey, labor at Park	702 00	
	W. W. Bassett, whitewashing	60 00	
	31—Wells, Fargo & Co., express	2 90	
	D. J. Ellis, express	1 50	
Sept.	2—W. A. Harms, fare for bicycle riders	95 00	
	3—Pool license	500 00	
	4—Goodyear Rubber Co., starting-gate	38 10	
	J. C. Boyd, surveying at Park	70 00	
	8—Postage stamps	5 00	
	James Cole, judging dog show	97 00	
	Spratts' Patent, dog benches	123 00	
	F. W. Covey, starter	240 00	
	James Touhey, work at Park	150 00	
	D. J. Sinclair, clerk of dog show	80 00	
	Wells, Fargo & Co., polo balls	26 75	
	James Withycombe, cattle judge	50 00	
	Mrs. C. Herndon, sewing	18 00	
	Joseph Marzen, freight on cattle	241 68	
	14—Revenue stamps	2 00	
	J. J. Callendun, Morse's Patrol	834 30	
	Charles A. Neale, music contract	1,916 00	
	H. Berrar, poultry and belgian hare judge	82 60	
	John Sparks, freight on cattle	129 80	
	T. H. Hurlick, selling auction pools	890 00	
	William Fieldwick, work at track	90 00	
	Harwood Hall, Superintendent Indian School	93 65	
	W. D. Nichols, watchman	50 00	
	Mrs. J. McGilvary, rent of barn	35 00	
	John A. Stanton, salary Superintendent of Art Department	200 00	
	P. Mamegowena, labor	42 00	
	John A. Stanton, postage	4 25	
	B. A. Johnson, Directors' stand	462 06	
	17—A. D. Wyman, cooking school	40 00	
	19—Postage	5 00	
	People's Express Co., cartage	1 00	
	Miss L. F. Dague, stenographer	79 00	
	Miss F. Allen, nurse	9 00	
	Stephen Addison, labor	5 00	
	26—Revenue stamps for checks	2 00	
	Melvin Gilson, carpenter work	6 15	
	W. F. Smith, salary	114 00	
	William McLaughlin, cartage	5 00	
	Game for dog show	10 00	
	Stationery	5 00	
	Telephone	1 15	
	L. J. Haaf, handlers' first prize, dog show	15 00	
	C. D. Dresser, handlers' second prize, dog show	7 50	
	J. Bradshaw, handlers' third prize, dog show	5 00	
	J. L. Dunn, Financial Secretary	150 00	
	F. J. Dunn, clerk	24 00	
	Judges butter contest	35 00	
	News Publishing Co., printing programmes	153 25	
Oct.	1—A. H. Flint, expressage	25	
	3—W. H. Gurry, veterinary services at Park	25 00	
	J. H. Campbell, cleaning cesspools	60 00	
	Postoffice box rent	2 50	
	Charles Bowling, rent of lot at Twentieth and F streets	25 00	
	5—A. Grubbs, labor at Park	16 00	
	Amount carried forward	$8,857 91	$2,416 40

1900.		Amount brought forward	$8,857 91	$2,416 40
Oct.	5—	James Touhey, work at track	431 25	
		Exchange, money orders	51	
	8—	Matt Coffey, superintendent poultry show	30 00	
		P. M. Robinson, straw	224 00	
		P. M. McGuire, rent of stalls	50 00	
		Mrs. F. P. Lowell, refund life membership	5 00	
		Postage	10 00	
Nov.	2—	Postage	10 00	
	27—	Postal cards	3 50	
		William McLaughlin, drayage	125 98	
Dec.	3—	Postage	10 00	
		P. M. McGuire, rent of barn	10 00	
		J. P. Callendine, glazing and painting	75 25	
		H. Lowden, handicapper and clerk of course	120 00	
		A. S. Killen, painting signs	38 95	
		George Murray & Son, hauling dirt	17 00	
		James Popert, sundries at Park	13 40	
		P. Flaherty, boarding Indians	18 05	
	4—	B. Kreuzberger, lime	1 50	
		Baker & Hamilton, hardware	8 60	
		H. W. Rivett, cleaning carpets	23 86	
		Postage stamps	10 00	
		M. N. Winans, ten days' use of horse and buggy	15 00	
		Mary C. Hinkson, engrossing diplomas	7 00	
	6—	Germeshausen & Magistrini, keys	1 75	
		Charles Flohr, repairing locks	75	
		Charles Farren, engrossing diplomas	4 50	
	8—	George Z. Wait, disinfectant	27 20	
		Melvin & Son, blacksmithing	39 25	
		D. O. Mills & Co., exchange	15	
		F. H. Veach, repairing turnstiles	33 50	
		D. O. Mills & Co., revenue stamps	2 40	
		James Jones, hay	288 60	
		J. Slaughter, whitewashing	168 50	
		James Touhey, claying track	3,160 90	
		Postal Telegraph Co., delivering telegrams	25	
		Phœnix Milling Co., millstuff	10 70	
		Schaw, Ingram, Batcher & Co., hardware	71 78	
		Pearl Jackson, services in office	6 00	
		Norton & Slaughter, cleaning sewer	40 00	
		W. A. Caswell, bill posting	32 50	
		A. Horabin, labor	1 00	
		Wells, Fargo & Co., expressage	20 70	
		Lewis Winter, engraving cut	12 00	
		Capital Telephone and Telegraph Co., use of 'phone	25 45	
		J. W. Bird, photographic work	13 00	
		Meiss Bros., horse hire at park	5 00	
		Buffalo Brewing Co., ice	35 85	
		California Winery, wines	45 50	
		A. S. Hopkins, sundries	41 85	
		Holbrook, Merrill & Stetson, hardware	20 40	
		Hall, Luhrs & Co., sundries	25 95	
		W. P. Fuller & Co., paints	21 05	
		A. Christie, trucking	18 00	
		C. M. Campbell, rent of carpets	24 75	
		P. McMorry, disinfectant	90	
		John Breuner, merchandise	13 30	
		Golden Eagle Hotel, account Withycombe	15 00	
		O. F. Washburn, shells for chickens	1 65	
		Egan Bros., cigars	11 50	
		Carlow & Miller, hardware	25 65	
	17—	W. F. Purnell, cards	75	
		Locke & Lavenson, hose	13 75	
		D. Johnston & Co., printing	41 75	
		H. E. Sleeper, rubber stamps	1 50	
		Sunset Telephone and Telegraph Co., use of 'phone	55 75	
		M. Gilson, building fence	27 00	
		E. M. Simpson, superintendent dog show	100 00	
		Postage	5 00	
		Spratt's Patent, disinfectant	1 25	
		John A. Stanton, picture breakage	10 90	
		Money orders	20	
		Amount carried forward	$14,641 84	$2,416 40

1900.	Amount brought forward	$14,641 84	$2,416 45
Dec. 27—	Thompson, Diggs & Co., hardware	7 36	
	C. Suter, millwork	47 35	
	Western Union Telegraph Co., telegrams	55 20	
	Pioneer Box Co., sawdust	65 00	
	State of California, carpets	10 00	
1901.			
Jan. 3—	Charles Flohr, door keys	1 00	
	Postage and box rent	7 50	
	Central California Electric Co., lights	235 25	
	Sacramento Electric, Gas, and Railway Co., lights	716 64	
	Hale Bros., sundries	165 04	
	J. A. Lafferty & Son., cartage	112 50	
	Capital Gas Co., gas	268 46	
	W. F. Frazer, lumber	986 35	
	Friend & Terry Lumber Co., lumber	296 40	
	J. W. Wilson & Son, livery	205 00	
	Grafmiller Bros., feed	126 48	
	Meiss Bros., teams	194 50	
	C. H. Krebs & Co., paint	161 45	
	A. Meister & Son, blacksmithing	154 05	
	John Mackey, for two horses	250 00	
	Brighton Milling Co., feed	143 64	
	A. K. Wackman, hay	192 57	
	George Boyne, decorations	415 00	
	William M. Murry, rent of lot for stables	10 00	
	Wasserman, Kaufman & Co., sundries	12 75	
	Weinstock, Lubin & Co., sundries	22 90	
	W. K. Cothrin, wood	12 00	
	Capital Telephone Co., use of 'phone	3 50	
	Postage	1 00	
	Mrs. Severance, return of entrance money	25 00	
	O. P. Dodge, expenses to San Francisco	34 00	
	H. Lowden, expenses in securing entries	100 00	
	Subscription Official Turf Guide	39 00	
	Postage	10 00	
	Stovepipe	50	
	Matt Coffey, rent of chicken coops	30 00	
	W. J. Irvine, livery hire	5 00	
	H. S. Crocker & Co., office supplies	80 30	
	William McLaughlin, drayage	2 75	
30—	Capital Telephone and Telegraph Co.	3 50	
	Sunset Telephone Co.	13 00	
	Allen's Press Clipping Bureau	15 00	
	Cronan & Wissemann, merchandise	10 25	
	George B. Stack, plumbing	3 00	
	B. A. Johnson, boarding polo men	23 65	
	Western Union Telegraph Co.	3 80	
	George B. Stack, plumbing	874 03	$20,793 51

PARK PRELIMINARY PAYROLL.

1900.			
Sept. 15—	George Ricker	$48 00	
	James Conlan	32 00	
	W. E. Parkhurst	46 00	
	Bernard Levy	51 00	
	John Renfro	60 00	
	Irvin Ellison	10 00	
	J. H. Patterson	8 00	
	M. Norton	12 00	
	James Talbert	12 00	
	Ed. Jensen	12 00	
	H. Callendine	12 00	
	C. Jenkins	18 00	
	R. Stevens	1 00	
	F. Corcoran	1 00	
	John Mehan	1 00	
	John Davis	1 00	
	William Roberts	92 00	
	Jerry West	64 00	
	R. Woolf	25 00	
	Mike Kinney	5 00	
	Ben Dashiel	10 25	$521 25
	Amount carried forward		$23,731 16

	Amount brought forward		$23,731 16

PARK PAYROLL.

1900.			
Sept. 15—	W. Roberts, carpenter	$104 00	
	George F. Byrne, laborer	85 00	
	E. Turner, laborer	24 00	
	H. Latham, watchman	60 00	
	Harry Sheehan, laborer	30 00	
	George T. Johnson, ticket clerk	56 00	
	Fred Allen, ticket clerk	30 00	
	J. P. Frazer, ticket clerk	30 00	
	H. Kirby, ticket clerk	30 00	
	Thomas Finnigan, laborer	24 00	
	Charles Wood, watchman	24 00	
	P. Byrnes, laborer	24 00	
	D. Brophy, laborer	24 00	
	H. Furry, laborer	24 00	
	W. H. Baker, teamster	43 50	
	T. L. Acock, watchman	24 00	
	S. Addison, laborer	24 00	
	John Dennison, laborer	24 00	
	John Dreman, watchman	24 00	
	R. Parker, laborer	24 00	
	Harry Baron, laborer	24 00	
	P. M. Boylan, laborer	24 00	
	Frank Bailey, laborer	24 00	
	J. H. Patterson, laborer	26 00	
	W. M. Foote, laborer	26 00	
	Eli Baker, laborer	27 00	
	Charles Kearney, laborer	24 00	
	Rice Hayes, laborer	1 00	
	A. Taylor, porter	22 00	
	D. J. Long, laborer	7 50	
	Albert F. Baker, laborer	24 00	
	George Vice, programme seller	60 00	
	B. Flaherty, watchman	2 00	
	A. Grubbs, porter grand stand	24 00	
	E. W. Lewis, entry clerk	60 00	
	Fred Chase, assistant entry clerk	40 00	
	Jack McMahon, laborer	5 00	
	P. Reagan, starter	120 00	
	W. H. Dorsey, assistant starter	60 00	
	S. Morton, assistant starter	60 00	
	C. S. Walsh, time flag	30 00	
	M. N. Winans, assistant superintendent of park	110 00	
	C. H. Ingham, blackboard announcements	65 00	
	D. O. Manning, caring for arm numbers	30 00	
	T. Halpin, charge jockey room	56 00	
	H. Jones, timer	48 00	
	R. Havey, timer	48 00	
	C. W. Aby, forage and badge clerk	60 00	
	G. W. Kelly, clerk of course	120 00	
	W. Fieldwick, superintendent of park	90 00	
	J. Dinue, assistant marshal	60 00	
	H. H. Cassidy, marshal	60 00	
	Sam McGibbon, work on programme	30 00	
	J. H. Patterson, night watchman	2 00	
	Dan Maloney, hay night watch	34 00	
	W. E. Parkhurst, laborer	48 00	
	M. Norton, laborer	28 00	
	S. Cady, laborer	28 00	
	M. M. Brady, laborer	42 00	
	R. Stephens, laborer	17 00	
	George Ricker, laborer	28 00	
	Bernard Levy, laborer	41 00	
	James Talbert, laborer	36 00	
	E. Jensen, laborer	14 00	
	J. Renfro, laborer	21 00	
	C. Jenkins, laborer	21 00	
	Thomas Clarke, laborer	13 00	
	A. McDonald	157 50	
			$2,730 50
	Amount carried forward		$26,461 66

Amount brought forward $26,461 66

Pavilion Payroll.

1900.			
Sept. 15	Mrs. L. J. Harlan, ladies' room	$24 00	
	Mrs. A. K. Quigley, caring for cases	42 50	
	Mrs. A. Chipman, entry clerk	54 00	
	Mrs. E. G. Clark, entry clerk	40 00	
	Mrs. Kennedy, entry clerk	37 50	
	L. A. Payen, watchman	24 00	
	G. W. Samuelson, watchman	23 75	
	J. B. Tetherington, watchman	32 50	
	C. B. Lightfoot, doorkeeper	67 75	
	Charles Cooley, doorkeeper	50 00	
	F. S. Holden, electrician	49 50	
	J. Murphy, office boy	15 00	
	W. D. Nichols, watchman	97 50	
	J. Bauquier, carpenter	1 40	
	M. Gilson, carpenter	114 00	
	A. Kennedy. carpenter	105 40	
	S. Steuben, carpenter	66 80	
	C. Devin, carpenter	34 25	
	E. M. Kister, carpenter	42 55	
	C. Ott, carpenter	62 50	
	J. W. James, carpenter	24 00	
	S. Greenwood, carpenter	16 00	
	S. G. Hess, laborer	127 75	
	C. H. Corson, laborer	106 25	
	A. Horabin, laborer	111 25	
	J. M. Tenbrook, laborer	92 75	
	N. Steiner, laborer	28 00	
	S. W. Haynie, laborer	70 50	
	J. B. Hill, laborer	90 25	
	W. Conley, laborer	69 75	
	Thomas Connor, laborer	90 20	
	I. W. Stinson, laborer	63 75	
	R. D. Gluyas, laborer	44 25	
	C. L. Stanfield, laborer	63 50	
	R. Helms, laborer	77 00	
	B. Kiernan, laborer	83 00	
	C. K. Wood, laborer	7 00	
	A. Galleato, laborer	50 75	
	H. Garratt, laborer	15 75	
	A. Silber, laborer	46 00	
	A. Hunter, laborer	15 00	
	T. H. Lynn, laborer	5 00	
	R. Woolf, laborer	41 00	
	George Davis, laborer	21 50	
	H. Ingham, laborer	56 50	
	Jack Donnallee, laborer	33 00	
	A. McInerny, laborer	3 00	
	William McMillan, laborer	3 00	
	Maurice Haley, laborer	37 00	
	George Davis, laborer	23 25	
	J. H. Hill, laborer	36 00	
	P. H. Scally, laborer	56 50	
	F. S. O'Brien, laborer	49 00	
	J. G. Donovan, laborer	13 50	
	J. F. Hill, laborer	22 50	
	Lloyd Kimball, laborer	2 40	
	A. Measure, laborer	6 00	
	W. Longbottom, chief ticket clerk	48 00	
	George L. Olds, assistant ticket clerk	30 00	
	H. Mathews, assistant ticket clerk	30 00	
	James H. Hooker, tending turnstiles	30 00	
	W. Longbottom, preparing tickets	32 00	
	S. E. Watson, superintendent dairy exhibit	200 00	
			$3,057 75

Amount carried forward $29,519 41

Amount brought forward		$29,519 41

INSURANCE.

1900.			
Aug. 6	W. P. Coleman	$87 55	
Dec. 21	Farady & Co.	42 40	
	Hawk & Carly	85 00	
22	J. N. Porter	51 00	
	Curtis, Carmichael & Brand	37 25	
	H. Kimbrough	63 60	
	Kromer, Wiseman & Wulff	63 70	
27	Hawley & Phillips	51 85	
	W. P. Coleman	11 90	
	H. J. Goethe	44 65	
	Frank Hickman	14 70	
			$553 60

RACES, 1900.

Race 1	The Occident Stake	$2,230 00	
2	Pacing purse, green class	600 00	
3	Selling purse	370 00	
4	Selling purse	320 00	
5	Selling purse	390 00	
6	Pacing stake, 2:20 class	490 00	
7	Trotting purse, 2:24 class	1,000 00	
8	Flash Stake	880 00	
9	Selling purse	330 00	
10	Selling purse	340 00	
10A	Polo pony race	120 00	
11	Pacing purse, 2:25 class	1,000 00	
12	Trotting purse, 2:10 class	800 00	
13	Shafter Selling Stake	660 00	
14	Selling purse	330 00	
15	Selling purse	320 00	
16	Pacing purse, 2:11 class	1,000 00	
17	Trotting purse, 2:15 class	1,000 00	
18	Dewey Selling Stake	840 00	
19	Selling purse	340 00	
20	Selling purse	350 00	
20A	Polo pony race	190 00	
21	Drummers' race, special	300 00	
22	Trotting purse, green class	600 00	
23	Running purse	370 00	
23A	Polo pony race	190 00	
24	Selling purse	340 00	
25	Selling purse	290 00	
26	Pacing purse, 2:15 class	1,000 00	
27	Trotting purse, 2:19 class	1,000 00	
28	Vinctor Stake	740 00	
29	Selling purse	310 00	
29A	Selling purse	390 00	
29B	Selling purse	280 00	
30	Stanford Stake	865 00	
31	Trotting purse, 2:12 class	1,000 00	
32	Selling purse	350 00	
33	Selling purse	340 00	
34	Selling purse	310 00	
35	Pacing purse, 2:18 class	1,000 00	
36	Trotting purse, 2:16 class	600 00	
37	Futurity Stake	2,480 00	
38	Selling purse	380 00	
39	Selling purse	340 00	
39A	Polo pony race	190 00	
40	Trotting purse, 2:21 class	1,000 00	
42	Trotting stake, 2:40 class	100 00	
43	Selling purse	310 00	
44	Selling purse	320 00	
45	Selling purse	330 00	
45A	Selling purse	320 00	
46	Sacramento County roadsters, special	250 00	
47	Free-for-all trot	720 00	
48	Sunny Slope Stake	630 00	
	Amount carried forward	$31,545 00	$30,073 01

Amount brought forward	$31,545 00	$30,073 01
Race 49—Capital City Stake	830 00	
50—Selling purse	300 00	
51—Trotting stake, 2:25 class	185 00	
52—Pacing purse, 2:21 class	540 00	
53—Selling purse	250 00	
54—Selling purse	250 00	
55—Selling purse	250 00	
55A—Selling purse	250 00	
56—Trotting purse, 2:30 class	1,000 00	
57—Pacing purse, 2:13 class	1,000 00	
58—California Annual Stake	810 00	
59—Favorite Stake	1,035 00	
60—Selling purse	250 00	
60A—Selling purse	250 00	
		$38,745 00

PREMIUMS.

First Department	$4,287 50	
Second Department	364 50	
Third Department	374 50	
Fourth Department	460 00	
Fifth Department	489 00	
Sixth Department	1,286 50	
Seventh Department	117 50	
Eighth Department	876 50	
Ninth Department	885 00	
W. K. Vanderslice & Co., medals	602 95	
Klune & Floberg, medals	25 00	
		$9,768 95

ENTRANCES DUE.

Race 1—Oakwood Stock Farm	$50 00	
George Fox	50 00	
7—William Proctor	30 00	
C. Raisch	50 00	
S. C. Tryon	50 00	
8—G. Brown	10 00	
11—E. Frisbie	50 00	
H. L. Myers	50 00	
W. S. Layng	50 00	
A. P. Meredith	50 00	
S. C. Tryon	50 00	
George Trank	10 00	
12—Tuttle Bros.	50 00	
14—J. Judge	10 00	
15—W. R. Larzelere	10 00	
18—W. R. Larzelere	10 00	
23—G. Brown	10 00	
26—G. Y. Bollinger	50 00	
S. C. Tryon	50 00	
27—D. Finn	50 00	
Jo Parrott	50 00	
28—W. R. Larzelere	10 00	
29—F. H. Smyth	10 00	
F. Walters	10 00	
31—Tuttle Bros.	50 00	
35—W. S. Layng	50 00	
L. D. Slocum	50 00	
Suel Harris	50 00	
E. Fraser	30 00	
W. P. Meredith	50 00	
37—John Mackey	200 00	
C. Boots	135 00	
38—W. R. Larzelere	10 00	
39—J. Wheeler	10 00	
W. R. Larzelere	10 00	
40—L. M. Clark	50 00	
James Coffin	30 00	
45A—C. Fink	10 00	
47—Tuttle Bros.	50 00	
Amount carried forward	$1,605 00	$78,586 96

	Amount brought forward	$1,605 00	$78,586 96
Race 52—	W. P. Meredith	30 00	
	W. Bemmerly	30 00	
	F. Wright	5 00	
56—	S. C. Tryon & Co.	50 00	
	E. J. Lane	50 00	
57—	A. M. Walden	26 67	
			$1,796 67

OTHER ASSOCIATIONS.

Collections made account entrances due	$807 55

SALARIES.

Peter J. Shields, Secretary	$1,966 60	
H. Lowden, Assistant Secretary	1,150 00	
Leon R. Miller, Stenographer	720 00	
Charles B. Herndon, Janitor	900 00	
D. M. Cox, Watchman	600 00	
		$5,336 60

BILLS PAYABLE.

Dec. 8—	Tom Scott	$155 50	
	Central California Electric Co.	225 00	
	Friend & Terry Lumber Co.	411 71	
	Schaw, Ingram, Batcher & Co.	154 69	
	George B. Stack	756 59	
	C. H. Krebs & Co.	354 50	
	T. B. Lovdal	177 00	
	Capital Gas Co.	252 87	
	Sacramento Electric, Gas, and Railway Co.	794 00	
	J. D. Coyle	167 53	
	California State Bank	213 00	
	A. J. Wilson	241 55	
17—	W. F. Frazer	938 29	
			$4,842 23

INTEREST.

Dec. 28—	California State Bank	$589 61	
	D. O. Mills & Co.	2,016 60	
	Sundry bills payable	184 95	
	D. O. Mills & Co.	43 45	
			$2,834 61
1901.			
Jan. 31—	Bank balance		$2,778 75
	Cash		1,316 26
			$98,299 63

PREMIUMS AWARDED—1900.

FIRST DEPARTMENT—LIVE STOCK.

HORSES.

Exhibit.	Exhibitor.	Award.
CLASS I—THOROUGHBRED HORSES.		
Stallions.		
Altamax, best four years old and over	Burns & Waterhouse, San Fran.	$30 00
King William, second best	Tod Sloan, Sacramento	15 00
Carlo, best one-year-old	Mrs. W. M. Murry, Sacramento	5 00
——, best colt under one year	Mrs. W. M. Murry, Sacramento	5 00
Mares.		
Jennie K. and colt, best four years and over with colt	Antrim Stock Farm, Bakersfield	30 00
Circe and colt, second best	Mrs. W. M. Murry, Sacramento	15 00
Jessie C., best four years old and over	Mrs. W. M. Murry, Sacramento	20 00
Lost Girl, second best	Mrs. E. F. Smith, Sacramento	10 00
Flamote, best three-year-old	Mrs. W. M. Murry, Sacramento	7 50
Orna, best two-year-old	Mrs. E. F. Smith, Sacramento	10 00
On Time, second best	Mrs. W. M. Murry, Sacramento	5 00
——, best one-year-old	Mrs. W. M. Murry, Sacramento	5 00
——, best colt under one year	Mrs. W. M. Murry, Sacramento	7 50
——, second best	Mrs. W. M. Murry, Sacramento	5 00
Families.		
King William, best thoroughbred and five colts	Tod Sloan, Sacramento	25 00
Play Foy and two colts, best thoroughbred dam	Antrim Stock Farm, Bakersfield	30 00
McKinney, best sire other than thoroughbred, and five colts	C. A. Durfee, Oakland	50 00
Belle Medium, best dam other than thoroughbred, and two colts	Tuttle Bros., Rocklin	30 00
CLASS II—STANDARD TROTTERS.		
Stallions.		
Zombro, best four years old and over	Mrs. Geo. T. Beckers, Los Angeles	30 00
Stam B., second best	Tuttle Bros., Rocklin	15 00
——, best one-year-old	Tuttle Bros., Rocklin	5 00
Guywood, best suckling colt	Mrs. E. W. Callendine, Sac'to	7 50
——, second best	Alex. Brown, Walnut Grove	5 00
Geo. Buchanan, best gelding	Farris Stock Farm, Sacramento	10 00
Mares.		
Belle Medium, best four years old and over with colt	Tuttle Bros., Rocklin	30 00
Whisper and colt, second best	Mrs. Geo. T. Beckers, Los Angeles	15 00
Grace McK., best four years old and over	Wm. Morgan, Pasadena	20 00
Abadina, second best	Mrs. E. W. Callendine, Sac'to	10 00
Wilkes Etta, best three-year-old	Mrs. E. W. Callendine, Sac'to	7 50
Mamie Martin, best two-year-old	Alex. Brown, Walnut Grove	10 00
Lady Keating, second best	Mrs. E. W. Callendine, Sac'to	5 00
Miss Ansel, best one-year-old	Alex. Brown, Walnut Grove	5 00
Lady Van Nuys, best suckling colt	Mrs. Geo. T. Beckers, Los Angeles	7 50
——, second best	Tuttle Bros., Rocklin	5 00

First Department—Horses—Continued.

Exhibit.	Exhibitor.	Award.
CLASS III—ROADSTERS.		
Geldings.		
Lorinel, best roadster gelding	Harris & Cook, Sacramento	$20 00
Talisman, second best	W. J. Irvine, Sacramento	10 00
Mares.		
Swiftbird, best roadster mare four years old and over	E. B. Smith, Sacramento	20 00
Rosalyn, best roadster mare three years old	Tuttle Bros., Rocklin	10 00
CLASS IV—COACH HORSES.		
Stallions.		
Darnetal, best four years old and over	Dr. J. J. Summerfield, Santa Rosa	30 00
Honest John, second best	Dr. J. H. Shirley, Sacramento	15 00
Prince, best two-year-old	C. Hashagen, Auburn	7 50
Mares.		
Bessie, best four years old with colt	Bud Cantrell, Elk Grove	30 00
Minnie, second best	Geo. T. Hennagin, Woodland	15 00
Sunflower, best four-year-old	Bud Cantrell, Elk Grove	10 00
Duke, best suckling colt	Bud Cantrell, Elk Grove	7 50
Mattie, second best	Geo. T. Hennagin, Woodland	5 00
CLASS V—CARRIAGE TEAMS.		
Jim Budd and Bow, best matched span carriage horses	Dan Flint, Sacramento	40 00
Nellie and Prince, second best	W. A. Caswell, Sacramento	20 00
CLASS VI—ROADSTER TEAMS.		
Mare and gelding, best double-team roadsters	Meek Estate, Haywards	30 00
John and Jim, second best	C. L. Smith, Sacramento	15 00
CLASS VII—DRAFT HORSES—NORMANS AND PERCHERONS.		
Stallions.		
Hercules, best four years old and over	Mrs. M. E. Sherman, Fresno	15 00
Cyrus Noble, best three-year-old	Lilienthal & Co., Pleasanton	10 00
Mares.		
Gavotte, best four years old and over	Mrs. M. E. Sherman, Fresno	10 00
Celeste, best two-year-old	Mrs. M. E. Sherman, Fresno	5 00
Lady Catherine, best one-year-old	Mrs. M. E. Sherman, Fresno	5 00
CLASS X—ENGLISH SHIRES.		
Mares.		
Pride of Prairie, best four years old and over	Meek Estate, Haywards	15 00
CLASS XI—HORSES OF ALL WORK.		
Uncle Sam, best four years old and over	Joseph Kiser, Napa	30 00
General Cronje, second best	John Grimes, Lakeville	15 00
Fresno, best three-year-old	Meek Estate, Haywards	20 00
Berton Jr., second best	R. W. Hanson, Rio Vista	10 00
Pluto, best two-year-old	Meek Estate, Haywards	15 00
Silver Cloud, second best	P. J. Carroll, Mills Station	7 50
Bowser, best one-year-old	Bud Cantrell, Elk Grove	10 00
Concord, second best	Joseph Kiser, Napa	5 00
Fred, best under one year	Geo. T. Hennagin, Woodland	7 50
George, second best	John Grimes, Lakeville	5 00

First Department—Horses—Continued.

Exhibit.	Exhibitor.	Award.
Mares.		
Hazel, best mare and suckling colt	Geo. T. Hennagin, Woodland	$30 00
Topsy, second best	M. F. Valine, Freeport	15 00
Jennie, best four years old and over	Geo. T. Hennagin, Woodland	20 00
Nellie, second best	Geo. T. Hennagin, Woodland	10 00
Jennie, best three-year-old	Geo. T. Hennagin, Woodland	15 00
Mollie C, second best	P. J. Carroll, Mills Station	7 50
Lucy, best two-year-old	Bud Cantrell, Elk Grove	10 00
Orphan Girl, second best	M. F. Valine, Freeport	5 00
Belle, best one-year-old	M. F. Valine, Freeport	7 50
Lucy, second best	Geo. T. Hennagin, Woodland	5 00
Florence, best suckling colt	Geo. T. Hennagin, Woodland	7 50
Blanche, second best	M. F. Valine, Freeport	5 00
CLASS XII—SADDLE HORSES.		
J. W., best saddle horse	A. J. Wilson, Sacramento	20 00
Solio, second best	E. N. Neilson, Sacramento	10 00
CLASS XIII—JACKS AND JENNIES.		
Sontag, best three years old and over	J. R. Jones, Madison	10 00
Patrick, best two-year-old	J. R. Jones, Madison	7 50
SPECIAL PREMIUMS.		
Mabel, Norman mare	R. W. Hanson, Rio Vista	20 00
Duchess, Clydesdale mare	Joseph Kiser, Napa	10 00
Flora, Clydesdale mare	Joseph Kiser, Napa	5 00
Suckling filly	Joseph Kiser, Napa	5 00
French Monarch, Jr.	M. F. Valine, Freeport	7 50
Suckling filly	Geo. T. Hennagin, Woodland	5 00

CATTLE.

CLASS I—SHORTHORNS.		
Bulls.		
Sharon Victor VI, best three years old and over	J. Marzen, Lovelock, Nevada	$30 00
Baden Duke XXXIII, second best	Baden Stock Farm, Lakeville	15 00
Noxubee Duke, best two-year-old	J. Marzen, Lovelock, Nevada	20 00
Baden Duke XL, second best	Baden Stock Farm, Lakeville	10 00
Nevada Boy XXIII, best one-year-old	J. Marzen, Lovelock, Nevada	15 00
Julius Cæsar, second best	Baden Stock Farm, Lakeville	7 50
Humboldt Victor, best bull calf	J. Marzen, Lovelock, Nevada	10 00
Nevada Boy XXIX, second best	J. Marzen, Lovelock, Nevada	5 00
Cows.		
Duchess of Humboldt VIII, best three-year-old	J. Marzen, Lovelock, Nevada	30 00
Lady Elgin IV, second best	J. Marzen, Lovelock, Nevada	15 00
Beauty H. II, best two-year-old	J. Marzen, Lovelock, Nevada	10 00
Humboldt Mary XII, best one-year-old	J. Marzen, Lovelock, Nevada	7 50
Red Bud XVI, best heifer calf	J. Marzen, Lovelock, Nevada	5 00
Herds.		
Sharon Victor VI and four cows, best herd of shorthorn cattle two years old and over	J. Marzen, Lovelock, Nevada	20 00
Nevada Boy XXIX and four heifers, best herd under two years	J. Marzen, Lovelock, Nevada	10 00
Sweepstakes.		
Waterfall II, best cow of any age	J. Marzen, Lovelock, Nevada	48 00

FIRST DEPARTMENT—CATTLE—Continued.

Exhibit.	Exhibitor.	Award.
CLASS II—HEREFORDS.		
Bulls.		
Aaron, best three years old and over	D. S. Cone, Red Bluff	$30 00
Armour Neptune XIII, second best	James Whitaker, Galt	15 00
Artisan, best two-year-old	J. Marzen, Lovelock, Nevada	20 00
Wilton Alamo, second best	James Whitaker, Galt	10 00
The Grove I, best one-year-old	John Sparks, Reno, Nevada	15 00
Miles, second best	James Whitaker, Galt	7 50
Lilax, best bull calf	John Sparks, Reno, Nevada	10 00
Perfection II, second best	John Sparks, Reno, Nevada	5 00
Cows.		
Armour Maid XV, best three years old and over	John Sparks, Reno, Nevada	30 00
Sunset V, second best	John Sparks, Reno, Nevada	15 00
Ida May, best two-year-old	John Sparks, Reno, Nevada	20 00
Armour Rose, second best	John Sparks, Reno, Nevada	10 00
Ethel Alamo, best one-year-old	John Sparks, Reno, Nevada	15 00
Sunset Alamo, second best	John Sparks, Reno, Nevada	7 50
——, best heifer calf	D. S. Cone, Red Bluff	10 00
Fallrose, second best	James Whitaker, Galt	5 00
Herds.		
Wilton Grove and four cows, best herd two years old and over	John Sparks, Reno, Nevada	40 00
The Grove I and four cows, best herd under two years	John Sparks, Reno, Nevada	20 00
Sweepstakes.		
Lilax, best bull of any age	John Sparks, Reno, Nevada	56 00
Armour Maid XV, best cow of any age	John Sparks, Reno, Nevada	48 00
CLASS VI—HOLSTEINS.		
Bulls.		
Gerben, best three years old and over	F. H. Burke, San José	15 00
Mechthildus of La Siesta, best two-year-old	F. H. Burke, San José	10 00
——, best one-year-old	F. H. Burke, San José	7 50
De Kol Albans, best bull calf	F. H. Burke, San José	5 00
Cows.		
Buttercup, best three years old and over	F. H. Burke, San José	15 00
Ariola of La Siesta, best two-year-old	F. H. Burke, San José	10 00
Alvah of La Siesta, best one-year-old	F. H. Burke, San José	7 50
——, best heifer calf	F. H. Burke, San José	5 00
Herds.		
Gerben and four cows, best herd two years old and over	F. H. Burke, San José	20 00
—— and four cows, best herd under two years	F. H. Burke, San José	10 00
Best calf herd	F. H. Burke, San José	2 00
Sweepstakes.		
Mechthildus of La Siesta, best bull of any age	F. H. Burke, San José	48 00
Buttercup, best cow of any age	F. H. Burke, San José	48 00
CLASS VII—JERSEYS.		
Bulls.		
Duarte, best three years old and over	S. J. McFarland, Napa	30 00
Kathleen's Roy of Y. B., second best	Henry Pierce, San Francisco	15 00
Aran of Y. B., best two-year-old	Henry Pierce, San Francisco	20 00
Onega's Recorder, second best	S. J. McFarland, Napa	10 00
Mentone of Y. B., best one-year-old	Henry Pierce, San Francisco	15 00
Prince David, second best	Peter J. Shields, Sacramento	7 50
Napa Boy, best bull calf	S. J. McFarland, Napa	10 00
Brown Dandy, second best	C. V. Osborn, Elk Grove	5 00

First Department—Cattle—Continued.

Exhibit.	Exhibitor.	Award.
Cows.		
Oleta's Alphea, best three years old and over	Peter J. Shields, Sacramento	$30 00
Ossie of Y. B., second best	Henry Pierce, San Francisco	15 00
Rosalee, best two-year-old	Henry Pierce, San Francisco	20 00
Salamagundi, second best	Henry Pierce, San Francisco	10 00
Stella Mc II, best one-year-old	S. J. McFarland, Napa	15 00
Claresa, second best	Henry Pierce, San Francisco	7 50
Vione's Dimple, best heifer calf	C. V. Osborn, Elk Grove	10 00
Zetta Zade, second best	C. V. Osborn, Elk Grove	5 00
Herds.		
Aran and four cows, best herd over two years	Henry Pierce, San Francisco	20 00
Fidelity and four cows, best herd under two years	Henry Pierce, San Francisco	20 00
Sweepstakes.		
Roy of Y. B., best bull of any age	P. J. Shields, Sacramento	48 00
Ossie, best cow of any age	Henry Pierce, San Francisco	52 00
CLASS VIII—HERD SWEEPSTAKES FOR BEEF CATTLE.		
Wilton Grove and four cows, best herd	John Sparks, Reno, Nevada	90 00
CLASS IX—GRAND SWEEPSTAKES FOR BEEF BREEDS.		
Bulls.		
Wilton Grove, best three years old and over	John Sparks, Reno, Nevada	39 00
The Grove I, best one-year-old	John Sparks, Reno, Nevada	18 00
Lilax, best bull calf	John Sparks, Reno, Nevada	13 00
Cows.		
Waterfall II, best three years old and over	J. Marzen, Lovelock, Nevada	36 00
Ida May LXXXVI, best two-year-old	John Sparks, Reno, Nevada	24 00
Ethel Alamo, best one-year-old	John Sparks, Reno, Nevada	18 00

SHEEP.

CLASS II—FRENCH MERINO.		
Best ram, two years old and over	J. H. Glide, Sacramento	$10 00
Best ram, one year old	J. H. Glide, Sacramento	7 00
Best three ram lambs	J. H. Glide, Sacramento	10 00
Best pen of five ewes, two years old and over	J. H. Glide, Sacramento	10 00
Best pen of five ewes, one year old and under two	J. H. Glide, Sacramento	10 00
Best pen of five ewe lambs	J. H. Glide, Sacramento	10 00
Best ram and five of his lambs	J. H. Glide, Sacramento	10 00
CLASS III—SOUTHDOWN.		
Best ram, any age	Thomas Waite, Perkins	20 00
Second best	George Bement, East Oakland	10 00
Best pen of five ewes, any age	George Bement, East Oakland	20 00
Second best	Thomas Waite, Perkins	10 00
Best ram and five of his lambs	Thomas Waite, Perkins	10 00
CLASS IV—PERSIAN SHEEP.		
Best ram, any age	C. P. Bailey, San José	10 00
Best pen of five ewes	C. P. Bailey, San José	10 00
Best ram and five of his lambs	C. P. Bailey, San José	10 00
CLASS V—COTSWOLD.		
Best ram, any age	Davis Bros., Dyer, Indiana	10 00
Best pen of five ewes, any age	Davis Bros., Dyer, Indiana	10 00
Best ram and five of his lambs	Davis Bros., Dyer, Indiana	10 00

First Department—Sheep—Continued.

Exhibit.	Exhibitor.	Award.
CLASS VI—SHROPSHIRE.		
Best ram, any age	J. H. Glide, Sacramento	$10 00
Best pen of five ewes	J. H. Glide, Sacramento	10 00
Best ram and five of his lambs	J. H. Glide, Sacramento	10 00
Best three ram lambs	J. H. Glide, Sacramento	7 50
Best five ewe lambs	J. H. Glide, Sacramento	7 50

ANGORA GOATS.

THOROUGHBREDS.		
Best buck, two years old and over	C. P. Bailey, San José	$15 00
Second best	C. E. Bailey, San José	7 50
Best buck under two years	C. P. Bailey, San José	10 00
Second best	C. E. Bailey, San José	5 00
Best pen of three does two years old	C. P. Bailey, San José	15 00
Second best	C. E. Bailey, San José	7 50
Best pen of three does under two years	C. E. Bailey, San José	10 00
Second best	C. P. Bailey, San José	5 00
Best herd of ten, any age or breed	C. P. Bailey, San José	25 00
Second best	C. E. Bailey, San José	10 00

SWINE.

CLASS I—BERKSHIRE.		
Boars.		
Artful Lee, best two years old and over	S. B. Wright, Santa Rosa	$20 00
Englishman, second best	Thomas Waite, Perkins	10 00
Lynwood Model, best one-year-old	Sessions & Co., Los Angeles	15 00
Lee Plattsburg, second best	S. J. McFarland, Napa	7 50
High Clere King IV of H. F., best six months old	J. P. Ashley, Linden	10 00
Baron Lynwood, second best	Sessions & Co., Los Angeles	5 00
Lady Metcalf V, best breeding sow two years old	Sessions & Co., Los Angeles	20 00
Ohio Queen, second best	J. P. Ashley, Linden	10 00
Miss Plattsburg, best one-year-old	Thomas Waite, Perkins	15 00
Silver Light XXV, second best	Sessions & Co., Los Angeles	7 50
Lady Gentry, best six months old	Thomas Waite, Perkins	10 00
Ohio Perfection, second best	J. P. Ashley, Linden	5 00
Maud G. and six pigs, best sow and six of her own pigs	J. P. Ashley, Linden	10 00
Elmer Fashion and Mr. Lee, best pair pigs under six months	Thomas Waite, Perkins	15 00
Gladstone and Fair Lass, second best	Sessions & Co., Los Angeles	7 50
Sweepstakes.		
Artful Lee, best boar of any age	S. B. Wright, Santa Rosa	30 00
Miss Plattsburg, best sow of any age	Thomas Waite, Perkins	26 00
CLASS II—ESSEX.		
Boars.		
Dandy, best two years old and over	J. P. Ashley, Linden	20 00
Black King, second best	L. F. Eaton, Cosumnes	10 00
Eureka, best one-year-old	J. P. Ashley, Linden	15 00
Ohio Major, second best	George Bement, Oakland	7 50
Contra Costa, best six months old	J. P. Ashley, Linden	10 00
Black Jack, second best	George Bement, Oakland	5 00

First Department—Swine—Continued.

Exhibit.	Exhibitor.	Award.
Sows.		
Black Bessie, best breeding sow two years old and over	George Bement, Oakland	$20 00
Jane, second best	George Bement, Oakland	10 00
California Duchess, best one-year-old	George Bement, Oakland	7 50
Mattie, best six months old	J. P. Ashley, Linden	10 00
Black Belle, second best	J. P. Ashley, Linden	5 00
Black Jennie and six pigs, best sow and six of her pigs	L. F. Eaton, Cosumnes	10 00
Best pair pigs under six months	J. P. Ashley, Linden	15 00
Second best	L. F. Eaton, Cosumnes	7 50
Sweepstakes.		
Eureka, best boar of any age	J. P. Ashley, Linden	28 00
Black Bessie, best sow of any age	George Bement, Oakland	28 00
Best pen of six pigs under six months	L. F. Eaton, Cosumnes	24 00
Best herd (one boar, two sows, and six pigs)	J. P. Ashley, Linden	24 00
CLASS III—POLAND-CHINA.		
Boars.		
Tecumseh Perfection, best two years old	S. P. Lindgren & Sons, Kingsburg	20 00
Young Buckeye, second best	W. R. McCaslin, Savannah	10 00
Iowa Chief, best one-year-old	J. P. Ashley, Linden	15 00
Nome, second best	Sessions & Co., Los Angeles	7 50
Hello! Look at Me, best six months old	J. P. Ashley, Linden	10 00
Adonis, second best	Sessions & Co., Los Angeles	5 00
Sows.		
Ohio Belle, best breeding sow two years old	W. R. McCaslin, Savannah	20 00
Perfect Queen, second best	Sessions & Co., Los Angeles	10 00
Dixie, best sow one-year-old	Sessions & Co., Los Angeles	15 00
Iowa Maid, second best	Sessions & Co., Los Angeles	7 50
Iowa Sunrise, best six months old	S. P. Lindgren & Sons, Kingsburg	10 00
Abra, second best	Sessions & Co., Los Angeles	5 00
Buckeye Girl, best sow and six pigs	W. R. McCaslin, Savannah	20 00
Kingsburg Lady, second best	J. P. Ashley, Linden	10 00
Doctor and Daisy, best pair pigs under six months	Sessions & Co., Los Angeles	15 00
Second best	W. R. McCaslin, Savannah	7 50
Sweepstakes.		
Hello! Look at Me, best boar of any age	J. P. Ashley, Linden	30 00
Ohio Belle, best sow of any age	W. R. McCaslin, Savannah	32 00
Best pen of six pigs	Sessions & Co., Los Angeles	26 00
Best herd (one boar, two sows, and six pigs)	S. P. Lindgren & Sons, Kingsburg	24 00

POULTRY.

LIGHT BRAHMAS.		
Best breeding pen	F. E. Mason, Alameda	$5 00
Best cock	T. B. C. Sielcken, Calistoga	1 50
Best hen	T. B. C. Sielcken, Calistoga	1 00
Second best	Mrs. F. H. Snow, San José	50
Best pullet	T. B. C. Sielcken, Calistoga	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Third best	T. B. C. Sielcken, Calistoga	50
DARK BRAHMAS.		
Best breeding pen	Mrs. F. H. Snow, San José	5 00
Best cock	Mrs. F. H. Snow, San José	1 50
Best hen	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Best cockerel	Mrs. F. H. Snow, San José	1 50

First Department—Poultry—Continued.

Exhibit.	Exhibitor.	Award.
BUFF COCHINS.		
Best breeding pen	Santa Teresa Poultry Farm, Edenvale	$5 00
Second best	Duncan A. Robertson, Alameda	1 00
Third best	G. A. Sealey, San José	1 50
Best cock	Santa Teresa Poultry Farm, Edenvale	1 50
Second best	Santa Teresa Poultry Farm, Edenvale	1 00
Third best	D. A. Robertson, Alameda	50
Best hen	Santa Teresa Poultry Farm, Edenvale	1 50
Second best	D. A. Robertson, Alameda	1 00
Third best	D. A. Robertson, Alameda	50
Best cockerel	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	Santa Teresa Poultry Farm, Edenvale	50
Best pullet	D. A. Robertson, Alameda	1 50
Second best	D. A. Robertson, Alameda	1 00
Third best	T. B. C. Sielcken, Calistoga	50
PARTRIDGE COCHINS.		
Best cock	T. B. C. Sielcken, Calistoga	1 50
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Best cockerel	W. P. Lyon, Edenvale	1 50
Second best	W. P. Lyon, Edenvale	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best pullet	W. P. Lyon, Edenvale	1 50
Third best	T. B. Sielcken, Calistoga	50
BLACK LANGSHANS.		
Best breeding pen	Mrs. F. P. Lowell, Oakland	5 00
Best cock	Chas. J. Guth, Sacramento	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	Mrs. F. P. Lowell, Oakland	50
Best hen	Mrs. F. P. Lowell, Oakland	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	Chas. J. Guth, Sacramento	50
Best cockerel	Mrs. F. P. Lowell, Oakland	1 50
Second best	Mrs. F. P. Lowell, Oakland	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best pullet	Mrs. F. P. Lowell, Oakland	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	T. B. C. Sielcken, Calistoga	50
WHITE LANGSHANS.		
Best cock	Mrs. F. H. Snow, San José	1 50
BARRED PLYMOUTH ROCKS.		
Best breeding pen	E. J. Boden, Sacramento	5 00
Second best	E. J. Boden, Sacramento	3 50
Third best	Geo. A. Sealey, San José	1 50
Best cock	E. C. Hopkins, Sacramento	1 50
Second best	Chas. J. Guth, Sacramento	1 00
Third best	Santa Teresa Poultry Farm, Edenvale	50
Best hen	E. J. Boden, Sacramento	1 50
Second best	E. J. Boden, Sacramento	1 00
Third best	L. N. Cobbledick, Oakland	50
Best cockerel	L. N. Cobbledick, Oakland	1 50
Second best	Santa Teresa Poultry Farm, Edenvale	1 00
Third best	L. N. Cobbledick, Oakland	50
Best pullet	E. J. Boden, Sacramento	1 50
Second best	E. J. Boden, Sacramento	1 00
Third best	Charles J. Guth, Sacramento	50

First Department—Poultry—Continued.

Exhibit.	Exhibitor.	Award.
WHITE PLYMOUTH ROCKS.		
Best breeding pen	W. A. Gilbert, Oak Park	$5 00
Best cock	C. G. Hinds & Co., Alameda	1 50
Second best	C. G. Hinds & Co., Alameda	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best hen	F. B. Van Nostrand, Alameda	1 50
Second best	C. G. Hinds & Co., Alameda	1 00
Third best	F. B. Van Nostrand, Alameda	50
Best cockerel	C. G. Hinds & Co., Alameda	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Third best	W. A. Gilbert, Oak Park	50
Best pullet	C. G. Hinds & Co., Alameda	1 50
Second best	C. G. Hinds & Co., Alameda	1 00
Third best	W. A. Gilbert, Oak Park	50
BUFF PLYMOUTH ROCKS.		
Best breeding pen	L. E. Brainard, San José	5 00
Best cock	L. E. Brainard, San José	1 50
Second best	L. E. Brainard, San José	1 00
Third best	Mrs. F. H. Snow, San José	50
Best hen	L. E. Brainard, San José	1 50
Second best	L. E. Brainard, San José	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best cockerel	L. E. Brainard, San José	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best pullet	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	T. B. C. Sielcken, Calistoga	50
BROWN LEGHORNS.		
Best breeding pen	J. R. Catlett, Pleasant Grove	5 00
Second best	Coffey Bros., Sacramento	3 50
Best cock	J. R. Catlett, Pleasant Grove	1 50
Second best	J. R. Catlett, Pleasant Grove	1 00
Third best	J. R. Catlett, Pleasant Grove	50
Best hen	J. R. Catlett, Pleasant Grove	1 50
Second best	J. R. Catlett, Pleasant Grove	1 00
Third best	J. R. Catlett, Pleasant Grove	50
Best cockerel	J. R. Catlett, Pleasant Grove	1 50
Second best	Coffey Bros., Sacramento	1 00
Third best	Coffey Bros., Sacramento	50
Best pullet	J. R. Catlett, Pleasant Grove	1 50
Second best	J. R. Catlett, Pleasant Grove	1 00
Third best	J. R. Catlett, Pleasant Grove	50
WHITE LEGHORNS.		
Best breeding pen	Santa Teresa Poultry Farm, Edenvale	5 00
Second best	Coffey Bros., Sacramento	3 50
Third best	Coffey Bros., Sacramento	1 50
Best cock	Coffey Bros., Sacramento	1 50
Second best	Santa Teresa Poultry Farm, Edenvale	1 00
Third best	Coffey Bros., Sacramento	50
Best hen	Santa Teresa Poultry Farm, Edenvale	1 50
Second best	Santa Teresa Poultry Farm, Edenvale	1 00
Third best	Coffey Bros., Sacramento	50
Best cockerel	Charles J. Guth, Sacramento	1 50
Second best	Santa Teresa Poultry Farm, Edenvale	1 00
Third best	Coffey Bros., Sacramento	50
Best pullet	Coffey Bros., Sacramento	1 50
Second best	Santa Teresa Poultry Farm, Edenvale	1 00
Third best	Coffey Bros., Sacramento	50

First Department—Poultry—Continued.

Exhibit.	Exhibitor.	Award.
BUFF LEGHORNS.		
Best breeding pen	L. E. Brainard, San José	$5 00
Second best	L. E. Brainard, San José	3 50
Third best	George A. Sealey, San José	1 50
Best cock	L. E. Brainard, San José	1 50
Second best	L. E. Brainard, San José	50
Best hen	L. E. Brainard, San José	1 50
Second best	L. E. Brainard, San José	1 00
Third best	L. E. Brainard, San José	50
Best cockerel	L. E. Brainard, San José	1 50
Second best	L. E. Brainard, San José	1 00
Third best	L. E. Brainard, San José	50
Best pullet	L. E. Brainard, San José	1 50
Second best	L. E. Brainard, San José	1 00
WHITE MINORCAS.		
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
BLACK MINORCAS.		
Best breeding pen	George A. Sealey, San José	5 00
Best cock	T. B. C. Sielcken, Calistoga	1 50
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	T. B. C. Sielcken, Calistoga	50
SILVER WYANDOTTES.		
Best breeding pen	Coffey Bros., Sacramento	5 00
Second best	Coffey Bros., Sacramento	3 50
Best cock	Coffey Bros., Sacramento	1 50
Best hen	Coffey Bros., Sacramento	1 50
Second best	Coffey Bros., Sacramento	1 00
Best cockerel	Coffey Bros., Sacramento	1 50
Second best	Coffey Bros., Sacramento	1 00
Third best	Coffey Bros., Sacramento	50
Best pullet	Coffey Bros., Sacramento	1 50
Second best	Coffey Bros., Sacramento	1 00
Third best	Coffey Bros., Sacramento	50
GOLDEN WYANDOTTES.		
Best breeding pen	Coffey Bros., Sacramento	5 00
Best cock	F. A. Hunter, Alameda	1 50
Second best	Coffey Bros., Sacramento	1 00
Best hen	F. A. Hunter, Alameda	1 50
Second best	F. A. Hunter, Alameda	1 00
Third best	Coffey Bros., Sacramento	50
Best pullet	F. A. Hunter, Alameda	1 50
Second best	F. A. Hunter, Alameda	1 00
WHITE WYANDOTTES.		
Best breeding pen	Santa Teresa Poultry Farm, Edenvale	5 00
Best cock	W. P. Lyon, Edenvale	1 50
Second best	W. P. Lyon, Edenvale	1 00
Third best	Santa Teresa Poultry Farm, Edenvale	50
Best hen	Santa Teresa Poultry Farm, Edenvale	1 50
Second best	T. B. Sielcken, Calistoga	1 00
Third best	T. B. Seilcken, Calistoga	50
Best cockerel	W. P. Lyon, Edenvale	1 50
Second best	Santa Teresa Poultry Farm, Edenvale	1 00
Third best	C. G. Hinds & Co., Alameda	50
Best pullet	Santa Teresa Poultry Farm, Edenvale	1 50
Second best	C. G. Hinds & Co., Alameda	1 00
Third best	T. B. C. Sielcken, Calistoga	50

First Department—Poultry—Continued.

Exhibit.	Exhibitor.	Award.
POLISH.		
Best breeding pen	Mrs. F. H. Snow, San José	$5 00
Best cock	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Best hen	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Third best	Mrs. F. H. Snow, San José	50
SILVER SPANGLED HAMBURGS.		
Best cock	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Best hen	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San Jose	1 00
Best pullet	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
GOLDEN SEABRIGHT BANTAMS.		
Best breeding pen	F. E. Mason, Alameda	5 00
Second best	L. E. Brainard, San José	3 50
Third best	Mrs. F. H. Snow, San José	1 50
Best cock	W. H. Deming, San Francisco	1 50
Second best	L. E. Brainard, San José	1 00
Third best	L. E. Brainard, San José	50
Best hen	L. E. Brainard, San José	1 50
Second best	W. H. Deming, San Francisco	1 00
Third best	W. H. Deming, San Francisco	50
Best cockerel	L. E. Brainard, San José	1 50
Second best	L. E. Brainard, San José	1 00
Third best	Mrs. F. H. Snow, San José	50
Best pullet	L. E. Brainard, San José	1 50
Second best	L. E. Brainard, San José	1 00
Third best	Mrs. F. H. Snow, San José	50
SILVER SEABRIGHT BANTAMS.		
Best hen	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Best pullet	Mrs. F. H. Snow, San José	1 50
BLACK-BREASTED RED GAME BANTAMS.		
Best breeding pen	Coffey Bros., Sacramento	5 00
Second best	Mrs. F. H. Snow, San José	3 50
Third best	L. E. Brainard, San José	1 50
Best cock	W. H. Deming, San Francisco	1 50
Second best	W. H. Deming, San Francisco	1 00
Third best	A. Stansfield, San José	50
Best hen	W. H. Deming, San Francisco	1 50
Second best	W. H. Deming, San Francisco	1 00
Third best	W. H. Deming, San Francisco	50
Best cockerel	Coffey Bros., Sacramento	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Best pullet	Mrs. F. H. Snow, San José	1 50
CORNISH INDIAN GAMES.		
Best breeding pen	Mrs. F. H. Snow, San José	5 00
Best hen	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Third best	Mrs. F. H. Snow, San José	50
Best pullet	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
HOUDANS.		
Best breeding pen	W. P. Lyon, Edenvale	5 00
Second best	W. P. Lyon, Edenvale	3 50
Third best	W. P. Lyon, Edenvale	1 50
Best cock	W. P. Lyon, Edenvale	1 50
Second best	W. P. Lyon, Edenvale	1 00
Third best	W. P. Lyon, Edenvale	50
Best hen	W. P. Lyon, Edenvale	1 50
Second best	W. P. Lyon, Edenvale	1 00
Third best	W. P. Lyon, Edenvale	50

First Department—Poultry—Continued.

Exhibit.	Exhibitor.	Award.
HOUDANS—*Continued.*		
Best cockerel	W. P. Lyon, Edenvale	$1 50
Second best	W. P. Lyon, Edenvale	1 00
Third best	W. P. Lyon, Edenvale	50
Best pullet	W. P. Lyon, Edenvale	1 50
Second best	W. P. Lyon, Edenvale	1 00
Third best	W. P. Lyon, Edenvale	50
WHITE COCHINS.		
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Best pullet	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Best cockerel	T. B. C. Sielcken, Calistoga	1 50
BLACK COCHINS.		
Best cock	T. B. C. Sielcken, Calistoga	1 50
Best hen	T. B. C. Sielcken, Calistoga	1 50
SILVER POLISH.		
Best cock	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Third best	Mrs. F. H. Snow, San José	50
Best hen	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Third best	Mrs. F. H. Snow, San José	50
Best cockerel	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
BUFF PEKIN BANTAMS.		
Best cock	Mrs. F. H. Snow, San José	1 50
Second best	W. H. Deming, San Francisco	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best hen	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Third best	W. H. Deming, San Francisco	50
Best pullet	Mrs. F. H. Snow, San José	1 50
SILVER DUCKLING BANTAMS.		
Best breeding pen	Mrs. F. H. Snow, San José	5 00
BLACK COCHIN BANTAMS.		
Best breeding pen	F. E. Mason, Alameda	5 00
RED PYLE GAME BANTAMS.		
Best cock	W. H. Deming, San Francisco	1 50
Best hen	W. H. Deming, San Francisco	1 50
Second best	W. H. Deming, San Francisco	1 00
WHITE COCHIN BANTAMS.		
Best cock	W. H. Deming, San Francisco	1 50
Best hen	W. H. Deming, San Francisco	1 50
Second best	W. H. Deming, San Francisco	1 00
BLACK COCHIN BANTAMS.		
Best cock	W. H. Deming, San Francisco	1 50
Best hen	W. H. Deming, San Francisco	1 50
BUFF ORPINGTONS.		
Best cock	F. B. Van Nostrand, Alameda	1 50
Second best	F. B. Van Nostrand, Alameda	1 00
Best pullet	F. B. Van Nostrand, Alameda	1 50
Second best	F. B. Van Nostrand, Alameda	1 00
SWEEPSTAKES.		
Best display	Mrs. F. H. Snow, San José	S.M.& $15

First Department—Poultry—Continued.

Exhibit.	Exhibitor.	Award.
TURKEYS.		
Best pair bronze	J. R. Catlett, Pleasant Grove	$8 00
Second best	T. B. C. Sielcken, Calistoga	5 00
Third best	J. R. Catlett, Pleasant Grove	2 00
GEESE.		
Best pair Toulouse geese	A. Rost, Sacramento	4 00
Second best	T. B. C. Sielcken, Calistoga	2 50
Third best	A. Rost, Sacramento	1 50
Best pair Emden geese	T. B. C. Sielcken, Calistoga	4 00
Second best	T. B. C. Sielcken, Calistoga	2 50
DUCKS.		
Best pair Pekin ducks	T. B. C. Sielcken, Calistoga	4 00
Second best	T. B. C. Sielcken, Calistoga	2 50
Third best	James Hague, Oakland	1 50

BELGIAN HARES.

INTERNATIONAL CHAMPIONSHIP.		
Open to the World.		
Best buck, any age	Mrs. Bond, Los Angeles	Sil. Med.
Best doe, any age	W. B. Sink, Jr., San Francisco	Sil. Med.
AMERICAN CHAMPIONSHIP.		
Open Only to American-bred Stock.		
Best buck, any age	Mrs. Bond, Los Angeles	Sil. Med.
Best doe, any age	G. F. Gillenwater, Sacramento	Sil. Med.
Open Only to Foreign-bred Stock.		
Best buck, ten months old and over	Mrs. Bond, Los Angeles	$3 00
Second best	G. F. Gillenwater, Sacramento	2 00
Best doe, ten months old and over	W. B. Sink, Jr., Oakland	3 00
Second best	Mrs. Bond, Los Angeles	2 00
Best buck, six months and under ten	M. F. Coppersmith, Sacramento	3 00
Second best	M. F. Coppersmith, Sacramento	2 00
Best doe, six months and under ten	M. F. Coppersmith, Sacramento	3 00
Second best	M. F. Coppersmith, Sacramento	2 00
Best doe and litter eight weeks old, not more than five in litter	A. Stansfield & Co., Los Angeles	5 00
Second best	G. F. Gillenwater, Sacramento	3 00
Third best	W. B. Sink, Jr., Oakland	2 00
Open Only to American-bred Stock.		
Best buck, ten months old and over	H. Langley, Los Angeles	3 00
Second best	G. F. Gillenwater, Sacramento	2 00
Third best	F. E. Mason, Alameda	1 00
Best doe, ten months old and over	M. F. Coppersmith, Sacramento	3 00
Second best	Ivanhoe Rabbitry, Sacramento	2 00
Third best	F. E. Mason, Alameda	1 00
Best buck, six months and under ten	H. Langley, Los Angeles	3 00
Second best	Sacramento Belgian Hare Co.	2 00
Third best	W. B. Sink, Jr., Oakland	1 00
Best doe, six months and under ten	G. F. Gillenwater, Sacramento	3 00
Second best	A. Stansfield & Co., Los Angeles	2 00
Third best	H. Langley, Los Angeles	1 00
Best buck, four months and under six	W. B. Sink, Jr., Oakland	3 00
Second best	G. F. Gillenwater, Sacramento	2 00
Third best	G. F. Gillenwater, Sacramento	1 00
Best doe, four months and under six	W. B. Sink, Jr., Oakland	3 00
Second best	G. F. Gillenwater, Sacramento	2 00
Third best	W. B. Sink, Jr., Oakland	1 00

BELGIAN HARES—Continued.

Exhibit.	Exhibitor.	Award.
Open Only to American-bred Stock.		
Best buck, under four months old	W. B. Sink, Jr., Oakland	$1 50
Second best	A. Stansfield & Co., Los Angeles	1 00
Third best	M. F. Coppersmith, Sacramento	50
Best doe, under four months old	Sacramento Belgian Hare Co.	3 00
Second best	A. Stansfield & Co., Los Angeles	1 00
Third best	W. B. Sink, Jr., Oakland	50
Best doe and litter not to exceed eight weeks old and not less than three nor more than five in litter	Mrs. Bond, Los Angeles	5 00
Second best	Cotton Bros., Sacramento	3 00
HEAVY-WEIGHT BELGIANS.		
Foreign or Domestic bred.		
Best buck, six months old and over	F. E. Mason, Alameda	2 00
Second best	Cotton Bros., Sacramento	1 00
Third best	Sacramento Belgian Hare Co.	50
Best doe, six months old and over	W. B. Sink, Jr., Oakland	2 00
Second best	Sacramento Belgian Hare Co.	2 00
Best buck, under six months old	W. F. Peterson, Sacramento	2 00
Best doe, under six months old	W. F. Peterson, Sacramento	2 00
Second best	W. F. Peterson, Sacramento	1 00
Best doe and litter, not to exceed eight weeks old, and not less than four nor more than six in litter	W. F. Peterson, Sacramento	3 00
FLEMISH GIANTS.		
Foreign or Domestic Bred.		
Best buck, any age	F. R. Capps, Campbell	2 50
Second best	F. R. Capps, Campbell	1 00
Best doe, any age	F. R. Capps, Campbell	2 00
Second best	A. Stansfield & Co., Los Angeles	1 00
MISCELLANEOUS.		
Best display of Dutch and Angora rabbits	Mrs. T. W. Hart, Sacramento	5 00
Second best	Wilbur F. Smith, Sacramento	2 50
SWEEPSTAKES.		
Best display of foreign-bred specimens	W. F. Peterson, Sacramento	5 00
Best display of American-bred specimens	M. F. Coppersmith, Sacramento	5 00
Best display of heavy-weight Belgian hares	W. B. Sink, Jr., Oakland	5 00

PREMIUMS AWARDED AT DOG SHOW, 1900.

Exhibit.		Exhibitor.	
ST. BERNARDS.			
Rough Coated—Novice Dogs.			
Omar Kayyam	First.	Mrs. Fred A. Getzler	Los Angeles.
Diablo II	Second.	Fritz F. Lueck	Sacramento.
Nero	Third.	Miss B. N. Reynolds	Oakland.
Rough Coated—Limit Dogs.			
Omar Kayyam	First.	Mrs. Fred A. Getzler	Los Angeles.
Diablo II	Second.	Fritz F. Lueck	Sacramento.
Sir Robert Bruce	Third.	Thos. D. Brown	San Francisco.
Rough Coated—Open Dogs.			
California Eboracum	First.	Oakland St. Bernard Kennels	Oakland.
Omar Kayyam	Second.	Mrs. Fred A. Getzler	Los Angeles.
Diablo II	Third.	Fritz F. Lueck	Sacramento.

PREMIUMS AWARDED AT DOG SHOW, 1900—Continued.

Exhibit.		Exhibitor.	
Rough Coated—Novice Bitches.			
Beauty	First.	Fritz F. Lueck	Sacramento.
Princess Nairod	Second.	J. H. Dorain	San Francisco.
Rough Coated—Limit Bitches.			
Beauty	First.	Fritz F. Lueck	Sacramento.
Princess Nairod	Second.	J. H. Dorain	San Francisco.
Rough Coated—Open Bitches.			
Alta Rachel	First.	Golden Gate St. Bernard Kennels	S. F.
Beauty	Second.	Fritz F. Lueck	Sacramento.
Lady Melba	Third.	Oakland St. Bernard Kennels	Oakland.
Smooth Coated—Novice Dogs and Bitches.			
Watch	First.	F. Cavagnaro	Stockton.
Smooth Coated—Limit Dogs and Bitches.			
General B.	First.	E. D. Connoley	San Francisco.
Smooth Coated—Open Dogs and Bitches.			
General B.	First.	E. D. Connoley	San Francisco.
Vienna	Second.	Mazzini Bros.	Sacramento.
GREAT DANES.			
Puppy Dogs.			
Bluebeard	First.	Posen Great Dane Kennels	San Francisco.
Novice Dogs.			
Bluebeard	First.	Posen Great Dane Kennels	San Francisco.
Open Dogs.			
Beau Brummel II	First.	I. C. Ackerman	San Francisco.
Puppy Bitches.			
Maud S.	First.	Enterprise Kennels	San Francisco.
Novice Bitches.			
Bluie	First.	Harry Masters	Stockton.
NEWFOUNDLANDS.			
Open Dogs and Bitches.			
Duke II	First.	Mrs. Phil. McFarland	Sacramento.
GREYHOUNDS.			
Dogs and Bitches over 50 lbs.			
Kelsey Shannon	First.	Pat Kelly	Sacramento.
Blackthorn	Second.	O'Brien Bros.	Sacramento.
Sunset	Third.	Ed. Walsh	Sacramento.
AMERICAN FOXHOUNDS.			
Limit Dogs.			
Murderer	First.	Stange & Henning	San Francisco.
Open Dogs.			
General Moltke	First.	Chas. K. Harley	San Francisco.
Open Bitches.			
Melba C.	First.	A. W. Combs	Oakland.
POINTERS.			
Novice Dogs.			
Sterling II	First.	T. B. Hall	Sacramento.
Dick	Second.	F. M. Newbert	Sacramento.

PREMIUMS AWARDED AT DOG SHOW, 1900—Continued.

Exhibit.		Exhibitor.	
Limit Dogs, under 55 lbs.			
Upton N.	First.	L. S. Upson	Sacramento.
Limit Dogs, 55 lbs. and over.			
Jack	First.	H. W. McConnell	Rocklin.
Miller	Second.	D. Leroy Crane	Sacramento.
Open Dogs, under 55 lbs.			
Lad of Glen	First.	Geo. Neale	Sacramento.
Limit Bitches, 50 lbs. and over.			
Sister Glenbeigh G.	First.	Wm. Gall	Mount Eden.
Topsy	Third.	Geo. Buckman	Sacramento.
Open Bitches, under 50 lbs.			
Patti M.	First.	T. B. Hall	Sacramento.
Nellie Glen	Second.	J. H. Burdett	Broderick.
Open Bitches, 50 lbs. and over.			
Queen N.	First.	Geo. Neale	Sacramento.
Sister Glenbeigh G.	Second.	Wm. Gall	Mount Eden.
ENGLISH SETTERS.			
Novice Dogs.			
Dockwood	First.	Harmon Bonte	Sacramento.
Duke of Danbury	Second.	Mrs. E. D. Adams	Sacramento.
Jaques	Third.	Mrs. E. M. Graham	Sacramento.
Open Dogs.			
Princewood	First.	Dr. W. Wood	Sacramento.
Open Bitches.			
Lady Orphan	First.	J. E. Terry	Sacramento.
IRISH SETTERS.			
Novice Dogs.			
Conn A.	First.	F. B. Adams	Sacramento.
Seminole III	Second.	Lillie Rible	Sacramento.
Open Dogs.			
Mike T. II	First.	John K. Brown	Sacramento.
Novice Bitches.			
Lady Emmett	First.	Mrs. J. K. Brown	Sacramento.
GORDON SETTERS.			
Limit Dogs and Bitches.			
T.	First.	Dr. J. H. Parkinson	Sacramento.
Open Dogs and Bitches.			
Crackerjack	First.	Louis D. Ehret	Sacramento.
FIELD SPANIELS.			
Open Dogs and Bitches.			
Royal Monarch III	First.	W. S. Kittle	San Francisco.
COCKER SPANIELS.			
Black—Puppy Dogs, not over 28 lbs.			
Dufferin Pastime	First.	Redwood Cocker Kennels	San Francisco.
Champion Viscount	Second.	Plumeria Cocker Kennels	San Francisco.
Echo	Third.	Bert McEldery	Sacramento.
Black—Novice Bitches.			
Lady Gaylord	First.	Hugh Mauldin	Sacramento.
Nellie	Second.	C. E. Bauer	Sacramento.

PREMIUMS AWARDED AT DOG SHOW, 1900—Continued.

Exhibit.		Exhibitor.	
Black—Limit Bitches.			
Sweetheart	First.	Mrs. J. P. Atkin	Alameda.
Peg Woffington	Second.	Redwood Cocker Kennels	San Francisco.
Black—Open Bitches.			
Mona II	First.	Mrs. J. P. Atkin	Alameda.
Other than Black—Puppy Dogs, not over 28 lbs.			
Li Hung Chang	First.	Redwood Cocker Kennels	San Francisco.
Other than Black—Limit Dogs, not over 28 lbs.			
Hampton Goldie	First.	Plumeria Cocker Kennels	San Francisco.
Other than Black—Puppy Bitches, not over 28 lbs.			
Empress Dowager	First.	Redwood Cocker Kennels	San Francisco.
Other than Black—Novice Bitches, not over 28 lbs.			
Baby Ora	First.	Mrs. T. J. Blight	San Francisco.
Other than Black—Limit Bitches, not over 28 lbs.			
La Paloma	First.	Redwood Cocker Kennels	San Francisco.
Other than Black—Open Bitches.			
Plumeria Fancy	First.	Plumeria Cocker Kennels	San Francisco.
Tootsie W.	Second.	Redwood Cocker Kennels	San Francisco.
COLLIES.			
Novice Dogs.			
Fuzzy Wuzzy	First.	Mrs. J. H. Parkinson	Sacramento.
Pensarn Ralph	Second.	M. Coffey	Sacramento.
Limit Dogs.			
Verona Battle	First.	Verona Kennels	Pleasanton.
Arnott's Rover	Second.	Miss Ethel Hammes	Sacramento.
Open Dogs.			
Verona Braw Scot	First.	Verona Kennels	Pleasanton.
Laddy	Second.	Geo. H. Scott	Sacramento.
Novice Bitches.			
Verona Belle	First.	James Arnott	Sacramento.
Lady Hall	Second.	Olive Grove Kennels	Florin.
Limit Bitches.			
Verona Moonlight	First.	Verona Kennels	Pleasanton.
Verona Belle	Second.	James Arnott	Sacramento.
Open Bitches.			
Verona Molly	First.	Verona Kennels	Pleasanton.
BULL DOGS.			
Open Dogs and Bitches.			
Harry Lacy	First.	L. S. Greenebaum	Sacramento.
BULL TERRIERS.			
Novice Dogs.			
McFadden	Second.	Mrs. Charles Beckwith	Sacramento.
Limit Dogs.			
Admiral	First.	W. J. H. White	San Francisco.
Open Dogs.			
Woodcote Venom II	First.	S. Christensen	San Francisco.

PREMIUMS AWARDED AT DOG SHOW, 1900—Continued.

Exhibit.		Exhibitor.	
Open Bitches.			
Woodcote Venus	First.	John I. Sparrow	San Francisco.
FOX TERRIERS.			
Smooth Coated—Puppy Dogs.			
Veracity	First.	W. J. Foster	San Francisco.
Kentucky Colonel	Second.	J. K. Russell	San Francisco.
Smooth Coated—Pacific Coast Bred Dogs.			
Russell Sage	First.	Charles K. Harley	San Francisco.
Smooth Coated—Limit Dogs.			
Alden Swagger	First.	J. B. Martin	San Francisco.
Russell Sage	Second.	Charles K. Harley	San Francisco.
Smooth Coated—Open Dogs.			
Warren Sceptic	First.	N. H. Hickman	San Francisco.
The Legnard	Second.	George Belle	Fruitvale.
Golden Flash II	Third.	Mrs. Alice M. Martin	San Francisco.
Smooth Coated—Puppy Bitches.			
Vina Belle	First.	W. W. Moore	San Francisco.
Madcap	Second.	Mrs. William Strachan	Walnut Creek.
Smooth Coated—Pacific Coast Bred Novice Bitches.			
Vina Belle	First.	W. W. Moore	San Francisco.
Nuisance	Second.	Mrs. Charles E. Turner	Vallejo.
Smooth Coated—Limit Bitches.			
Carmencita	First.	Charles K. Harley	San Francisco.
Vina Belle	Second.	W. W. Moore	San Francisco.
Dottie	Third.	J. B. Martin	San Francisco.
Smooth Coated—Open Bitches.			
Carmencita	First.	Charles K. Harley	San Francisco.
Golden Restless	Second.	Mrs. E. M. Simpson	Sacramento.
Elmwood Vassar	Third.	N. H. Hickman	San Francisco.
Wire Haired—Puppy Dogs.			
Lathrop Cronje	First.	F. J. Walker	Lathrop.
Wire Haired—Open Bitches.			
Eclipse Trilby	Second.	Thornhill Kennels	Fruitvale.
IRISH TERRIERS.			
Limit Dogs and Bitches.			
Barney F.	First.	E. Courtney Ford	San Francisco.
Open Dogs and Bitches.			
Barney F.	First.	E. Courtney Ford	San Francisco.
PUGS.			
Puppy Bitches.			
Tiny	First.	J. B. Atwood	Sacramento.
TOY TERRIERS—OTHER THAN YORKSHIRE.			
Over Seven Pounds.			
Baby	First.	Mrs. G. M. Davidson	Sacramento.
Under Seven Pounds.			
Jimmy	First.	Mrs. G. M. Davidson	Sacramento.
Topsy	Second.	Abe Wilson	Sacramento.
Punch	Third.	Mrs. G. M. Davidson	Sacramento.

PREMIUMS AWARDED AT DOG SHOW, 1900—Continued.

Exhibit.	Exhibitor.
JAPANESE SPANIELS.	
Open Dogs and Bitches.	
Nippon ---------- First.	Mrs. H. W. Reddan---------East Berkeley.
ITALIAN GREYHOUNDS.	
Open Dogs and Bitches.	
Chiquita ---------- First.	Redwood Cocker Kennels---San Francisco.

A special silver medal was awarded the Redwood Cocker Kennels for the best kennel of Black Cockers, and one also for the best kennel of Red Cockers.

A special silver medal was awarded the Verona Kennels for the best kennel of Collies.

SECOND DEPARTMENT.

MACHINERY, IMPLEMENTS, ETC.

Exhibit.	Exhibitor.	Award.
CLASS I—MACHINERY, ENGINES, ETC.		
Best road roller, other than traction	Wm. Wildman, Pomona	Diploma.
Best steam engine, California manufacture	Joshua Hendy Machine W'ks, S. F.	$25 00
Best apparatus for raising water for irrigating	P. K. Wood, Los Angeles	20 00
Best spray pump for orchards	Thomson-Diggs Co., Sacramento	20 00
Best well pump	Thomson-Diggs Co., Sacramento	10 00
Best vapor or gas engine	Thomson-Diggs Co., Sacramento	2 00
Best gas machine in operation	E. R. Cook, Sacramento	20 00
CLASS II—AGRICULTURAL MACHINES—FIRST DIVISION.		
Best horse hay rake	Thomson-Diggs Co., Sacramento	5 00
Best gopher trap	Thomson-Diggs Co., Sacramento	1 00
Best vegetable cutter	Thomson-Diggs Co., Sacramento	1 00
Best display of agricultural machinery by any one house, California manufacture	Benicia Agricultural Works	20 00
Best lawn sprinkler	Holbrook, Merrill & Stetson, Sac.	1 00
Best cider mill and press	Baker & Hamilton, Sacramento	1 00
Best hay press	Baker & Hamilton, Sacramento	5 00
Best power corn sheller	Baker & Hamilton, Sacramento	1 00
CLASS III—AGRICULTURAL MACHINES—SECOND DIVISION.		
Best broadcast sowing machine	Thomson-Diggs Co., Sacramento	5 00
Best mowing machine	Thomson-Diggs Co., Sacramento	5 00
Best wheat drill	Thomson-Diggs Co., Sacramento	10 00
Best one-horse cultivator	Thomson-Diggs Co., Sacramento	5 00
Best self-binding harvester	Sacramento Implement Co.	5 00
Best corn planter	Sacramento Implement Co.	1 00
Best potato digger	Sacramento Implement Co.	1 00
Best cultivator	Sacramento Implement Co.	5 00
Best field roller and crusher	Benicia Agricultural Works	1 00
Best combined clod-crusher, harrow, pulverizer, and leveler	Benicia Agricultural Works	2 00
Best self-rake reaping machine	Silas Orr, Sacramento	5 00
Best disk harrow	Silas Orr, Sacramento	5 00

SECOND DEPARTMENT—MACHINERY, ETC.—Continued.

Exhibit.	Exhibitor.	Award.
CLASS IV—AGRICULTURAL MACHINES—THIRD DIVISION.		
Best windmill	Holbrook, Merrill & Stetson, Sac.	$10 00
Best wire park or paddock fence	Thomson-Diggs Co., Sacramento	1 00
Best wire fence stretcher	Thomson-Diggs Co., Sacramento	1 00
Best wire farm gate	Thomson-Diggs Co., Sacramento	1 00
Best agricultural boiler	Joshua Hendy Machine W'ks, S. F.	Diploma.
Best platform scales	G. G. Wickson & Co., S. F.	Sil. Med.
Best beehive, without bees	The A. S. Hopkins Co., Sac'to	$1 00
Best fanning mill	Baker & Hamilton, Sacramento	1 00
CLASS V—TOOLS AND HOUSEHOLD IMPLEMENTS.		
Best freestone pitter	Thomson-Diggs Co., Sacramento	5 00
Best pruning shears	Thomson-Diggs Co., Sacramento	2 50
Best washing machine	Mrs. J. P. Strauch, Sacramento	Diploma.
Best cabbage cutter	The A. S. Hopkins Co., Sac'to	$2 00
Best sausage meat cutter and stuffer	The A. S. Hopkins Co., Sac'to	2 00
Best clothes wringer	The A. S. Hopkins Co., Sac'to	1 00
Best mangle or ironing machine	The A. S. Hopkins Co., Sac'to	1 00
Best clothes horse, to occupy least space	The A. S. Hopkins Co., Sac'to	1 00
Best egg carrier	The A. S. Hopkins Co., Sac'to	2 00
Best fruit gatherer	The A. S. Hopkins Co., Sac'to	2 00
Best fruit grader	G. G. Wickson & Co., S. F.	5 00
Best display of haying and harvesting tools	Baker & Hamilton, Sacramento	5 00
Best road scraper	Baker & Hamilton, Sacramento	5 00
Best garden and seed drill	Baker & Hamilton, Sacramento	1 00
CLASS VI—PLOWS.		
Best gang plow	Benicia Agricultural Works	5 00
Best sulky plow	Benicia Agricultural Works	5 00
Best road plow	Benicia Agricultural Works	5 00
Best sod plow	Benicia Agricultural Works	5 00
Best two or three-horse plow	Benicia Agricultural Works	5 00
Best subsoil plow	Benicia Agricultural Works	5 00
Best sidehill plow	Benicia Agricultural Works	5 00
Best vineyard plow	Benicia Agricultural Works	5 00
CLASS VII—VEHICLES.		
Best closed family carriage	Thomson-Diggs Co., Sacramento	Dip. & $10
Best farm wagon for general purposes	Thomson-Diggs Co., Sacramento.	$10 00
Best business wagon	Thomson-Diggs Co., Sacramento	10 00
Best lady's trap or phaeton	A. Meister & Sons, Sacramento	10 00
Best open family carriage	A. Meister & Sons, Sacramento	Dip. & $10
Best open buggy	A. Meister & Sons, Sacramento	$10 00
Best two-seat open wagon	A. Meister & Sons, Sacramento	10 00
Best single seat trotting wagon	A. Meister & Sons, Sacramento	10 00
Best top buggy	A. Meister & Sons, Sacramento	Dip. & $10
Best training cart	O'Brien & Sons, San Francisco	Diploma.
Best track sulky	O'Brien & Sons, San Francisco	Sil. Med.
CLASS VIII—MISCELLANEOUS.		
Best header and harvester drapers	White, Cooley & Cutts, Marysville	Diploma.
Best saw gummer	Thomson-Diggs Co., Sacramento	$1 00
Best buckboard	Thomson-Diggs Co., Sacramento	2 00
Best exhibit of locomobiles	Locomobile Co. of the Pacific, S. F.	Sil. Med.
Best wagonjack	Azusa Manufacturing Co., Azusa	Diploma.
For Wood's propelling pump	P. K. Wood, Los Angeles	Diploma.
Best gasoline engine	Silas Orr, Sacramento	Sil. Med.
Best hay tedder	Silas Orr, Sacramento	Diploma.

THIRD DEPARTMENT.

TEXTILE FABRICS, AND THE MATERIALS FROM WHICH THEY ARE MADE.

Exhibit.	Exhibitor.	Award.
CLASS I—CLOTHING AND KINDRED TEXTURES.		
Special premium	Weinstock, Lubin & Co., Sac'to	$25 00
Best exhibit of men's hats and caps	D. H. Quinn, Sacramento	Sil. Med.
Best silk hat	D. H. Quinn, Sacramento	Diploma.
Best soft hat	D. H. Quinn, Sacramento	Diploma.
Best display of fancy goods	Bauer Bros., Sacramento	$10 00
Best exhibit of men's clothing	The Charles P. Nathan Co., Sac'to	2 00
Best exhibit of boys' clothing	The Charles P. Nathan Co., Sac'to	1 00
Best gentlemen's shirts	The Charles P. Nathan Co., Sac'to	2 00
Best exhibit of neckwear	The Charles P. Nathan Co., Sac'to	2 00
Best knitted shawl	Mrs. S. Hastings, Sacramento	3 00
Best display of dry goods	Weinstock, Lubin & Co., Sac'to	10 00
Best exhibit of ladies' shoulder braces and corsets	Mrs. A. M. Jones, Sacramento	Sil. Med.
CLASS II—NEEDLE AND FANCY WORK AND DECORATIVE PAINTING.		
Best display of ladies' underwear	Weinstock, Lubin & Co., Sac'to	$10 00
Best hand sewing, not less than three pieces	Mrs. W. H. Davy, Sacramento	2 00
Best embroidery on flannel	Mrs. W. H. Davy, Sacramento	3 00
Best embroidered tea cloth	Miss E. A. C. Janson, San Fran.	3 00
Best embroidered infant's pillow	Miss E. A. C. Janson, San Fran.	3 00
Best embroidered tray cloth	Mrs. S. Hastings, Sacramento	3 00
Largest and finest display of silk embroidery on linen	Miss E. A. C. Janson, San Fran.	10 00
Best embroidered sideboard cover	Miss Mae Stelling, Sacramento	3 00
Best embroidered table runner	Miss Mae Stelling, Sacramento	2 00
Best embroidered centerpiece and doilies	Miss Mae Stelling, Sacramento	3 00
Largest and finest display of Turkish embroidery	Mrs. V. Jones, San Francisco	3 00
Largest and finest display of outline embroidery	Mrs. E. Adams, Stockton	2 00
Best embroidered table set on linen	Mrs. E. Adams, Stockton	3 00
Best embroidered table set on silk	Mrs. E. Adams, Stockton	5 00
Best embroidered handkerchief case	Mrs. S. Hastings, Sacramento	2 00
Best embroidered glove case	Mrs. S. Hastings, Sacramento	2 00
Best embroidery	Miss E. A. C. Janson, San Fran.	3 00
Best embroidery on silk	Mrs. E. A. C. Janson, San Fran.	2 00
Best embroidered bedspread	Mrs. Jos. Marzen, Lovelock, Nev.	3 00
Best Queen Anne embroidery	Mrs. E. Adams, Stockton	3 00
Best combination of tinting and embroidery	Miss E. A. C. Janson, San Fran.	3 00
Best set of embroidered napkins or doilies	Mrs. S. Hastings, Sacramento	3 00
Best Empire style of embroidery	Mrs. E. Adams, Stockton	3 00
Best white cotton embroidery on linen	Mrs. W. H. Davy, Sacramento	5 00
Best display of embroidered picture frames	Miss E. A. C. Janson, San Fran.	5 00
Best, largest, and handsomest display of embroidered or hand-painted sofa pillows	Mrs. E. Adams, Stockton	15 00
Best delft blue center embroidery	Miss E. A. C. Janson, San Fran.	3 00
Best embroidered round centerpiece	Miss E. A. C. Janson, San Fran.	3 00
Best Honiton lace work	Miss Mary Jones, Sacramento	3 00
Best display of knit lace by hand	Mrs. W. H. Davy, Sacramento	5 00
Best display of crochet lace	Mrs. S. Hastings, Sacramento	3 00
Best Danish drawn work	Mrs. Wm. Gill, Oakland	3 00
Best Battenburg work	Miss Mary Jones, Sacramento	3 00
Best set of Spanish drawn work, napkins or doilies	Mrs. Wm. Gill, Oakland	3 00
Best display of decorated baskets	Miss E. A. C. Janson, San Fran.	5 00
Best display of fancy bags	Miss E. A. C. Janson, San Fran.	3 00
Best lounge afghan	Mrs. S. Hastings, Sacramento	3 00

Third Department—Textile Fabrics—Continued.

Exhibit.	Exhibitor.	Award.
Best carriage afghan	Mrs. S. Hastings, Sacramento	$3 00
Best patchwork quilt	Mrs. A. E. Taylor, Sacramento	3 00
Best crazy patchwork quilt	Miss Mary Jones, Sacramento	3 00
Best crocheted bedspread	Miss Mabel Pozzi, Healdsburg	3 00
Best display of point lace	Mrs. F. H. Wood, Suisun	5 00
Best hearth rug, hand made	Mrs. A. E. Taylor, Sacramento	2 00
Best knit mittens	Mrs. S. Hastings, Sacramento	1 00
Best crocheted or knitted purse	Mrs. S. Hastings, Sacramento	1 00
Best tapestry painting	Mrs. E. Adams, Stockton	10 00
Best painted paul	Mrs. E. Adams, Stockton	2 00
Best display of millinery	Weinstock, Lubin & Co., Sac'to	2 00
Best velvet bonnet	Weinstock, Lubin & Co., Sac'to	5 00
Best velvet hat	Weinstock, Lubin & Co., Sac'to	5 00
Best wood carving	Miss A. Wagner, Los Angeles	3 00
Best tabouret, burnt wood etching	Miss Pearl Waggoner, Sac'to	3 00
Best piano or hall seat, burnt wood etching	Miss Pearl Waggoner, Sac'to	3 00
Best table, burnt wood etching	Miss Pearl Waggoner, Sac'to	3 00
Best bookcase, burnt wood etching	Miss Pearl Waggoner, Sac'to	3 00
Best music rack, burnt wood etching	Miss Pearl Waggoner, Sac'to	3 00
Best panel, burnt wood etching	Miss Pearl Waggoner, Sac'to	3 00
Best display of pyrography	Miss Pearl Waggoner, Sac'to	5 00
Best display of etching on leather	Miss A. Wagner, Los Angeles	5 00
Best, largest, and handsomest display of above articles made by one lady	Mrs. T. H. Wood, Suisun	20 00
Best course service	Miss E. Kennedy, Sacramento	5 00
Best figure piece	Mrs. Fannie Spaulding, Sac'to	3 00
Best landscape piece	Mrs. Fannie Spaulding, Sac'to	2 00
Best game piece	Mrs. Fannie Spaulding, Sac'to	2 00
Best jardiniere or bowl	Mrs. Fannie Spaulding, Sac'to	2 00
Best vase or piece of bric-a-brac	Mrs. Fannie Spaulding, Sac'to	2 00
Best set of plates, not less than six	Mrs. Fannie Spaulding, Sac'to	5 00
Best set of cups and saucers	Mrs. Fannie Spaulding, Sac'to	5 00
Best tea, coffee, or chocolate set	Mrs. Fannie Spaulding, Sac'to	5 00
Best tray or large plate	Mrs. Fannie Spaulding, Sac'to	2 00
Best single piece in delft decoration	Mrs. Fannie Spaulding, Sac'to	3 00
Best, largest, and handsomest display	Mrs. Fannie Spaulding, Sac'to	20 00
Best flower piece	Miss E. Kennedy, Sacramento	2 00
Best fruit piece	Miss E. Kennedy, Sacramento	2 00
Best single piece	Miss E. Kennedy, Sacramento	3 00
Best cracker or rose bowl	Miss E. Kennedy, Sacramento	2 00
JUVENILE DEPARTMENT.		
Best and most tastily made dress by a miss	Miss Maria Gill, Sacramento	5 00
Best silk embroidery	Miss Maria Gill, Sacramento Sil.	Thimble.
Best and largest assortment of paper dolls	Anita Barrett, Sacramento	$1 50
Best and handsomest dressed doll	Anita Barrett, Sacramento	5 00
Second best	Elsie Barrett, Sacramento	3 00
Third best	Elsie Barrett, Sacramento	2 00
Best painting in water colors	Harrietta Gill, Sacramento	Book.
Best pen drawing	Harrietta Gill, Sacramento Sil.	Penhol'er
Exhibit of fancy pictures	Mrs. Mary Menzel, Florin	Diploma.
Best display of ladies' and children's wear by a factory	Bauer Bros., Sacramento	Diploma.
For general display	Mabel Pozzi, Healdsburg	Diploma.
For meritorious display	Mrs. V. Jones, San Francisco	$1 00
For general display	Nick Bath, Sacramento	Sil. Med.
For display of lace work	Mrs. E. Hoffner, Folsom	Sil. Med.
CLASS III—PRINTING, LITHOGRAPHING, ETC.		
Best display of stationery	J. N. Larkin & Co., Sacramento	Sil. Med.
Best specimen of printing from half tones	J. N. Larkin & Co., Sacramento	Sil. Med.

FOURTH DEPARTMENT.

MECHANICAL PRODUCTS.

Exhibit.	Exhibitor.	Award.
CLASS I—MANUFACTURES OF LEATHER, PAPER, AND RUBBER.		
Best pair boots, California manufacture	A. Casselli, Sacramento	$5 00
Best pair heavy boots, California manufacture	A. Casselli, Sacramento	5 00
Best display of men's and boys' boots, shoes, gaiters, etc.	A. Casselli, Sacramento	2 00
Best pair gentlemen's shoes, California manufacture	C. P. Nathan Co., Sacramento	5 00
Best pair ladies' shoes, California manufacture	C. P. Nathan Co., Sacramento	5 00
Best display of ladies' and girls' boots, shoes, and gaiters	C. P. Nathan Co., Sacramento	2 00
Best display of leather gloves and mittens	C. P. Nathan Co., Sacramento	2 00
Best display of men's and boys' boots and shoes, gaiters, etc.	Philadelphia Shoe House, Sac'to	Diploma.
Best general display of paper manufactured in California, not less than two tons	The A. S. Hopkins Co., Sac'to	$2 00
Best display of cordage	The A. S. Hopkins Co., Sac'to	2 00
CLASS II—WORKED METALS.		
Best display of metal ornaments for outside work on buildings	Holbrook, Merrill & Stetson, Sac.	5 00
Best display of brass or copper cooking utensils	Holbrook, Merrill & Stetson, Sac.	10 00
Best display of brass goods, other than cooking utensils	Holbrook, Merrill & Stetson, Sac.	10 00
Best display of plumbers' goods and wares	Holbrook, Merrill & Stetson, Sac.	2 00
Best display of electric lamps in decorating	Holbrook, Merrill & Stetson, Sac.	10 00
Best display of plated flatware	Holbrook, Merrill & Stetson, Sac.	5 00
Best display of kitchen utensils of tin and tinware	Holbrook, Merrill & Stetson, Sac.	5 00
Best milk can	Holbrook, Merrill & Stetson, Sac.	1 00
Best sample of block-tin pipe	Holbrook, Merrill & Stetson, Sac.	1 00
Best exhibit of lead pipe	Holbrook, Merrill & Stetson, Sac.	1 00
Best display of wire goods	Holbrook, Merrill & Stetson, Sac.	5 00
Best horseshoes, hand made	William Bennett, Woodland	5 00
Best display of glass chandeliers and burners	John Breuner Co., Sacramento	5 00
Best display of table cutlery	John Breuner Co., Sacramento	2 00
CLASS III—STOVES, CASTINGS, ETC.		
Best cooking stove, for coal	Holbrook, Merrill & Stetson, Sac.	5 00
Best cooking stove, for wood	Holbrook, Merrill & Stetson, Sac.	5 00
Best parlor stove, for coal	Holbrook, Merrill & Stetson, Sac.	5 00
Best gas stove	Holbrook, Merrill & Stetson, Sac.	5 00
Best wickless oil stove	Holbrook, Merrill & Stetson, Sac.	5 00
Best laundry stove	Holbrook, Merrill & Stetson, Sac.	5 00
Best warming furnace or other apparatus	Holbrook, Merrill & Stetson, Sac.	5 00
Best pair of ornamental iron vases	Holbrook, Merrill & Stetson, Sac.	3 00
Best display of hollow ware	Holbrook, Merrill & Stetson, Sac.	5 00
Best farmers' caldrons or steamers	Holbrook, Merrill & Stetson, Sac.	5 00
Best display of enameled bath and wash tubs	Holbrook, Merrill & Stetson, Sac.	5 00
Best water and steam gates	Holbrook, Merrill & Stetson, Sac.	1 00
Best portable range, for wood	L. L. Lewis & Co., Sacramento	5 00
Best portable range, for coal	L. L. Lewis & Co., Sacramento	5 00
Best assortment of japanned ware	Holbrook, Merrill & Stetson, Sac.	5 00

FOURTH DEPARTMENT—MECHANICAL PRODUCTS—Continued.

Exhibit.	Exhibitor.	Award.
CLASS V—FURNITURE.		
Best display of iron furniture	Mrs. F. W. Klopfer, Sacramento	$10 00
Best set of bedroom furniture	C. M. Campbell, Sacramento	5 00
Best spring mattress	C. M. Campbell, Sacramento	5 00
Best hair mattress	C. M. Campbell, Sacramento	5 00
Best wool mattress	C. M. Campbell, Sacramento	3 00
Best set of parlor chairs	C. M. Campbell, Sacramento	10 00
Best sick chair or couch	C. M. Campbell, Sacramento	5 00
Best display of furniture	John Breuner Co., Sacramento	Diploma.
Best dining-room furniture	John Breuner Co., Sacramento	$10 00
Best sofa	John Breuner Co., Sacramento	10 00
Best lounge	John Breuner Co., Sacramento	5 00
Best extension table	John Breuner Co., Sacramento	5 00
Best display of upholstery	John Breuner Co., Sacramento	10 00
Best set of parlor furniture	Weinstock, Lubin & Co., Sac'to	20 00
Best dressing bureau	Weinstock, Lubin & Co., Sac'to	10 00
CLASS VI—WOODENWARE.		
Best display of cedarware	The A. S. Hopkins Co., Sac'to	5 00
Best display of pineware	The A. S. Hopkins Co., Sac'to	5 00
Best display of oakware	The A. S. Hopkins Co., Sac'to	5 00
Best display of willowware	The A. S. Hopkins Co., Sac'to	5 00
Best display of splitwood baskets	The A. S. Hopkins Co., Sac'to	3 00
Best display of turning lathe work	The A. S. Hopkins Co., Sac'to	5 00
Best display of osier	The A. S. Hopkins Co., Sac'to	5 00
Best assortment of cooper's ware	The A. S. Hopkins Co., Sac'to	5 00
Best assortment of woodenware	The A. S. Hopkins Co., Sac'to	5 00
Best display of matches in quality and variety	The A. S. Hopkins Co., Sac'to	1 00
Best exhibition of broomcorn, brooms, and brushes	The A. S. Hopkins Co., Sac'to	5 00
Best display of fancy mouldings and scroll sawing	The A. S. Hopkins Co., Sac'to	5 00
CLASS VII—ELECTRICAL APPLIANCES, ETC.		
Best electric cooking apparatus	Holbrook, Merrill & Stetson, Sac.	5 00
Best incandescent lamps	Holbrook, Merrill & Stetson, Sac.	5 00
Best assortment of spectacles and eyeglasses, showing different styles and shapes of nose pieces	A. J. Bailey, Sacramento	Sil. Med.
Best assortment of all kinds of finished convex, cylindrical, and plano lenses	A. J. Bailey, Sacramento	Diploma.
Best assortment of all kinds of unfinished concave, convex, cylindrical, and plano lenses	A. J. Bailey, Sacramento	Diploma.
Best optical apparatus	A. J. Bailey, Sacramento	Diploma.
Best thermometer	A. J. Bailey, Sacramento	Diploma.
Best barometer	A. J. Bailey, Sacramento	Diploma.
Best electrical generator and dynamo	Electrical Construction Co., Sac.	$5 00
For IXL truss	Prof. A. A. McLean, San Francisco	Sil. Med.
CLASS VIII—CHEMICALS.		
Best stove polish, to be tested	Holbrook, Merrill & Stetson, Sac.	$2 00
Best display of soap	The A. S. Hopkins Co., Sac'to	S.M. & $5
Best display of toilet soap	The A. S. Hopkins Co., Sac'to	1 00
Best exhibit of axle grease	The A. S. Hopkins Co., Sac'to	1 00
Best starch, California manufacture	Bates & Co., San Francisco	Sil. Med.
CLASS IX—STONEWARE, BRICK, TILES, CROCKERY, GLASS, ETC.		
Best sample of drain tile	Henry Cowell & Co., Sacramento	$5 00
Best display of terra cotta	Henry Cowell & Co., Sacramento	10 00
Best display of fire brick	Henry Cowell & Co., Sacramento	3 00
Best display of pressed brick	Henry Cowell & Co., Sacramento	1 00
Best hydraulic cement	Henry Cowell & Co., Sacramento	1 00
Best plaster	Henry Cowell & Co., Sacramento	1 00
Best exhibit of slate	Holbrook, Merrill & Stetson, Sac.	5 00

Fourth Department—Mechanical Products—Continued.

Exhibit.	Exhibitor.	Award.
CLASS IX—STONEWARE, BRICK, TILES, CROCKERY, GLASS, ETC.		
Best sewer pipe	George Muddox, Sacramento	$5 00
Best water pipe	George Muddox, Sacramento	2 00
Best display of stoneware	Egan Bros., Sacramento	10 00
Best demijohns	The A. S. Hopkins Co., Sac'to	1 00
Best display of ornamental cut, embossed, and bent glass	John Breuner Co., Sacramento	1 00
CLASS X—MINERALS, FOSSILS, BIRDS, FISHES, ETC.		
Best suite of minerals of California	Cal. Gold & Copper Co., Spencev'le	10 00
CLASS XI—MARBLE AND GRANITE WORK.		
Best display of marble lavatories	Holbrook, Merrill & Stetson, Sac.	2 00
CLASS XII—INCUBATORS.		
Best display of incubators in operation	Jubilee Incubator Co., Oakland	25 00
For incubator hatching the greatest number of chicks during the show	Jubilee Incubator Co., Oakland	5 00
Best display of brooders	Jubilee Incubator Co., Oakland	10 00
CLASS XIII—MISCELLANEOUS.		
For California medicated soap	Mrs. M. E. Dollard, Sacramento	Diploma.
For Quaker folding Turkish bath cabinet	H. A. Gear, Sacramento	Diploma.
Best bottling plant	C. Schnerr & Co., Sacramento	$1 00
Pneumatic cement	Pneumatic Corker Co., Fernando	Sil. Med.
For acetylene lamps and lanterns	E. R. Cook, Sacramento	Diploma.
For acetylene gas machine	New Century Gas Mach. Co., Benicia	Diploma.
For Pasteur germ filter	Egan Bros., Sacramento	$1 00
For square inch tailor garment cutter	Misses L. & C. Dawson, Sac'to	Diploma.
For sunshine water heater	Sunshine Water Heater Co., S. F.	Sil. Med.
For display of natural gas	Sacramento Natural Gas Co., Sac.	Diploma.
Medicated complexion soap	Mrs. F. E. Libby, Sacramento	Diploma.

FIFTH DEPARTMENT.

DAIRY PRODUCTS AND DAIRY UTENSILS.

Exhibit.	Exhibitor.	Award.
CLASS I—FRESH BUTTER.		
First premium	J. R. Murphy, Fresno	$50 00
Second premium	Sunset Creamery, Loleta	45 00
Third premium	Point Arena Creamery, Pt. Arena	40 00
Fourth premium	Soran Iverson, Point Arena	35 00
Fifth premium	Spring Brook Creamery, Sierraville	30 00
Sixth premium	Hollister Creamery, Hollister	25 00
Seventh premium	Stockton Creamery, Stockton	20 00
Eighth premium	Hydesville Creamery, Hydesville	15 00
Ninth premium	Jos. Sheppard Creamery, Pt. Arena	10 00
Tenth premium	Oak Leaf Creamery, Bolsa	5 00
STORAGE BUTTER.		
First premium	Hollister Creamery, Hollister	30 00
Second premium	Edenco Creamery, Petaluma	25 00
Third premium	Knights Landing Creamery, Grafton	20 00
Fourth premium	Sunset Creamery, Halfmoon Bay	15 00
Fifth premium	Bodega Creamery Co., Bodega	10 00
Sixth premium	Fallon Creamery, Fallon	5 00

FIFTH DEPARTMENT—DAIRY PRODUCTS AND UTENSILS—Continued.

Exhibit.	Exhibitor.	Award.
EXPORT BUTTER.		
First premium	Brigham, Hoppe & Co., S. F.	Sil. Med.
Second premium	Dairymen's Union, S. F.	Brz. Med.
Third premium	Hilmer & Bredhoff, S. F.	Diploma.
CHEESE.		
First premium	Robert Nichols, Sheldon	$10 00
BUTTER COLOR.		
For Alderney Butter Color	Heller, Merz & Co., New York	Diploma.
CLASS II—DAIRY MACHINERY.		
Best power cream separator	DeLaval Separator Co., S. F.	$10 00
Best hand cream separator	DeLaval Separator Co., S. F.	5 00
Best combined churn and worker	G. G. Wickson & Co., San Fran.	10 00
Best cream cooler	G. G. Wickson & Co., San Fran.	5 00
Best milk aërator and cooler	G. G. Wickson & Co., San Fran.	5 00
Best cream ripening vat	G. G. Wickson & Co., San Fran.	5 00
Best milk delivery can	G. G. Wickson & Co., San Fran.	5 00
Best hand churn	G. G. Wickson & Co., San Fran.	2 00
Best hand churn	G. G. Wickson & Co., San Fran.	2 00
Best complete creamery outfit ready for operation	Joshua Hendy Mach. Wks., S. F.	Gold M.
Best milk tester	Joshua Hendy Mach. Wks., S. F.	$10 00
Best butter cutter and moulder	Joshua Hendy Mach. Wks., S. F.	5 00
Best shipping box	Joshua Hendy Mach. Wks., S. F.	5 00
Best cheese press	Joshua Hendy Mach. Wks., S. F.	5 00
Best curd mill	Joshua Hendy Mach. Wks., S. F.	3 00
Best hand butter worker	Joshua Hendy Mach. Wks., S. F.	2 00
Best refrigerating machine for creamery use	Joshua Hendy Mach. Wks, S. F.	25 00

SIXTH DEPARTMENT.

HORTICULTURAL PRODUCTS.

Exhibit.	Exhibitor.	Award.
CLASS I—DECIDUOUS FRUITS.		
Apples.		
Best display, embracing quality and variety	R. C. Williamson, Auburn	$25 00
Second best	Mrs. E. Shields, Sacramento	15 00
Best arranged exhibit	R. C. Williamson, Auburn	10 00
Best twelve varieties	R. C. Williamson, Auburn	5 00
Best five varieties	R. C. Williamson, Auburn	3 00
Best packed box for shipment	Mrs. E. Shields, Sacramento	3 00
Pears.		
Best display, embracing quality and variety	Mrs. E. Shields, Sacramento	25 00
Second best	R. C. Williamson, Auburn	15 00
Best arranged exhibit	R. C. Williamson, Auburn	10 00
Best twelve varieties	Mrs. E. Shields, Sacramento	5 00
Best five varieties	Mrs. E. Shields, Sacramento	3 00
Best packed box for shipment	Mrs. E. Shields, Sacramento	3 00
Peaches.		
Best display, embracing quality and variety	Mrs. E. Shields, Sacramento	25 00
Second best	R. C. Williamson, Auburn	15 00
Best arranged exhibit	Mrs. E. Shields, Sacramento	10 00
Second best	R. C. Williamson, Auburn	5 00
Best twelve varieties	Mrs. E. Shields, Sacramento	10 00
Second best	R. C. Williamson, Auburn	5 00
Best five varieties	Mrs. E. Shields, Sacramento	7 50
Best packed box for shipment	Mrs. E. Shields, Sacramento	5 00

SIXTH DEPARTMENT—HORTICULTURAL PRODUCTS—Continued.

Exhibit.	Exhibitor.	Award.
CLASS I—DECIDUOUS FRUITS.		
Nectarines.		
Best display, embracing quality and variety	R. C. Williamson, Auburn	$25 00
Second best	Mrs. J. P. Odbert, Sacramento	15 00
Best arranged exhibit	R. C. Williamson, Auburn	10 00
Best five varieties	R. C. Williamson, Auburn	3 00
Plums and Prunes.		
Best display, embracing quality and variety	R. C. Williamson, Auburn	25 00
Second best	Mrs. E. Shields, Sacramento	15 00
Best arranged exhibit	R. C. Williamson, Auburn	10 00
Second best	Mrs. E. Shields, Sacramento	10 00
Best twelve varieties	R. C. Williamson, Auburn	10 00
Second best	Mrs. E. Shields, Sacramento	10 00
Best five varieties	R. C. Williamson, Auburn	7 50
Second best	Mrs. E. Shields, Sacramento	7 50
Figs.		
Best display, embracing quality and variety	R. C. Williamson, Auburn	10 00
Second best	Mrs. E. Shields, Sacramento	7 50
Best five varieties	R. C. Williamson, Auburn	5 00
Second best	Mrs. E. Shields, Sacramento	3 00
CLASS II—OLIVES.		
For most meritorious exhibit	R. C. Williamson, Auburn	12 50
Best exhibit of cured or pickled olives (ripe)	R. C. Williamson, Auburn	5 00
Best exhibit of pickled olives (green)	R. C. Williamson, Auburn	10 00
Second best	Mrs. J. P. Odbert, Sacramento	5 00
Best exhibit of dried olives	Mrs. J. P. Odbert, Sacramento	10 00
Second best	R. C. Williamson, Auburn	5 00
CLASS III—VEGETABLE OILS.		
Best exhibit of olive oil, embracing quality and variety	D. Johnston & Co., Cool	25 00
Best exhibit of 24 bottles of olive oil	D. Johnston & Co., Cool	15 00
CLASS IV—CULTIVATED NUTS.		
Best exhibit of walnuts, embracing quality and variety	Mrs. J. P. Odbert, Sacramento	15 00
Second best	B. Muddox, Sacramento	10 00
Best ten varieties of walnuts	Mrs. J. P. Odbert, Sacramento	15 00
Second best	B. Muddox, Sacramento	7 50
Best and largest exhibit of almonds	Mrs. J. P. Odbert, Sacramento	15 00
Second best	Mrs. E. Shields, Sacramento	10 00
Best ten varieties of almonds	Mrs. J. P. Odbert, Sacramento	15 00
Second best	R. C. Williamson, Auburn	7 50
Best exhibit of pecans	Mrs. J. P. Odbert, Sacramento	5 00
Second best	Mrs. E. Shields, Sacramento	3 00
Best exhibit of filberts	Mrs. J. P. Odbert, Sacramento	5 00
Best exhibit of chestnuts	R. C. Williamson, Auburn	5 00
Best exhibit of peanuts	B. Muddox, Sacramento	5 00
CLASS V—TABLE GRAPES.		
Best display, embracing quality and variety	Mrs. E. Shields, Sacramento	25 00
Second best	R. C. Williamson, Auburn	15 00
Best twelve varieties	Mrs. E. Shields, Sacramento	10 00
Second best	R. C. Williamson, Auburn	5 00
Best five varieties	Mrs. E. Shields, Sacramento	5 00
Second best	R. C. Williamson, Auburn	3 00
Best three varieties	Mrs. E. Shields, Sacramento	5 00
Second best	R. C. Williamson, Auburn	3 00
CLASS VI—DRIED AND PRESERVED FRUITS.		
Largest and best exhibit of dried fruit	Mrs. E. Shields, Sacramento	50 00
Second best	Mrs. J. P. Odbert, Sacramento	25 00
Best 25 lbs. dried apples by producer	Mrs. E. Shields, Sacramento	5 00
Second best	Mrs. J. P. Odbert, Sacramento	3 00

Sixth Department—Horticultural Products—Continued.

Exhibit.	Exhibitor.	Award.
CLASS VI—DRIED AND PRESERVED FRUITS.		
Best 25 lbs. dried pears by producer	Mrs. J. P. Odbert, Sacramento	$5 00
Second best	Mrs. E. Shields, Sacramento	3 00
Best 25 lbs. dried peaches by producer	R. C. Williamson, Auburn	5 00
Second best	Mrs. J. P. Odbert, Sacramento	3 00
Best 25 lbs. dried plums by producer	Mrs. E. Shields, Sacramento	5 00
Second best	Mrs. J. P. Odbert, Sacramento	3 00
Best 25 lbs. dried prunes by producer	Mrs. E. Shields, Sacramento	5 00
Second best	Mrs. J. P. Odbert, Sacramento	3 00
Best 25 lbs. dried apricots by producer	R. C. Williamson, Auburn	5 00
Second best	Mrs. J. P. Odbert, Sacramento	3 00
Best 25 lbs. dried nectarines by producer	Mrs. E. Shields, Sacramento	5 00
Second best	Mrs. J. P. Odbert, Sacramento	3 00
Best packed commercial box dried apples	Mrs. E. Shields, Sacramento	5 00
Best packed commercial box dried peaches	Mrs. E. Shields, Sacramento	5 00
Best packed commercial box dried pears	Mrs. E. Shields, Sacramento	5 00
Best packed commercial box dried plums	Mrs. E. Shields, Sacramento	5 00
Best packed commercial box dried prunes	Mrs. E. Shields, Sacramento	5 00
Best packed commercial box dried apricots	Mrs. E. Shields, Sacramento	5 00
Best packed commerc'l box dried nectarines	Mrs. E. Shields, Sacramento	5 00
Best variety dried prunes	Mrs. E. Shields, Sacramento	5 00
CLASS VII—DRIED FRUIT COOKING FORMULAS.		
Best exhibit of cooked dried fruit, with formula	Mrs. E. Shields, Sacramento	50 00
CLASS IX—HONEY, PRESERVES, PICKLES, ETC.		
Best display of jams and jellies, in glass	Mrs. J. P. Odbert, Sacramento	25 00
Second best	Mrs. B. Muddox, Sacramento	15 00
Best display of honey	Robt. Yenshaw, Sacramento	20 00
Second best	Irene Woods, Sacramento	10 00
Best display of preserved fruits, in glass	Mrs. B. Muddox, Sacramento	10 00
Second best	Mrs. J. P. Odbert, Sacramento	5 00
Best strawberry jelly	Mrs. A. Barrett, Sacramento	2 00
Best raspberry jelly	Mrs. B. Muddox, Sacramento	2 00
Best six jars currant jelly	Mrs. E. Shields, Sacramento	3 00
Second best	Mrs. B. Muddox, Sacramento	2 00
Best six jars blackberry jelly	Mrs. E. Shields, Sacramento	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best six jars lemon jelly	Mrs. A. Barrett, Sacramento	3 00
Second best	Mrs. J. P. Odbert, Sacramento	2 00
Best six jars quince jelly	Mrs. A. Barrett, Sacramento	3 00
Second best	Mrs. E. Shields, Sacramento	2 00
Best six jars guava jelly	Mrs. B. Muddox, Sacramento	3 00
Second best	Mrs. J. P. Odbert, Sacramento	2 00
Best six jars orange jelly	Mrs. J. P. Odbert, Sacramento	3 00
Second best	Mrs. B. Muddox, Sacramento	2 00
Best six jars loquat jelly	Mrs. A. Barrett, Sacramento	3 00
Second best	Mrs. B. Muddox, Sacramento	2 00
Best six jars plum jelly	Mrs. A. Barrett, Sacramento	3 00
Second best	Mrs. E. Shields, Sacramento	2 00
Best six jars apple jelly	Mrs. E. Shields, Sacramento	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best six jars grape jelly	Mrs. A. Barrett, Sacramento	3 00
Second best	Mrs. J. P. Odbert, Sacramento	2 00
Best six jars apricot jelly	Mrs. B. Muddox, Sacramento	3 00
Second best	Mrs. J. P. Odbert, Sacramento	2 00
Best six jars blackberry jam	Mrs. E. Shields, Sacramento	3 00
Second best	Mrs. B. Muddox, Sacramento	2 00
Best six jars raspberry jam	Mrs. B. Muddox, Sacramento	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best six jars chowchow	Mrs. E. Shields, Sacramento	3 00
Second best	Mrs. J. P. Odbert, Sacramento	2 00
Best display of pickles	Mrs. B. Muddox, Sacramento	3 00
Best sweet pickled peaches	Mrs. E. Shields, Sacramento	3 00
Second best	Mrs. J. P. Odbert, Sacramento	2 00
Best display of orange marmalade	Mrs. E. Shields, Sacramento	3 00
Second best	Mrs. B. Muddox, Sacramento	2 00

Sixth Department—Horticultural Products—Continued.

Exhibit.	Exhibitor.	Award.
CLASS IX—HONEY, PRESERVES, PICKLES, ETC.		
Best display of pickled onions	Mrs. B. Muddox, Sacramento	$3 00
Best display of brandied peaches	Mrs. J. P. Odbert, Sacramento	3 00
Best display of fig marmalade	Mrs. J. P. Odbert, Sacramento	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best sweet pickled grapes	Mrs. A. Barrett, Sacramento	3 00
Best sweet pickled peaches	Mrs. A. Barrett, Sacramento	2 00
CLASS X—CANNED AND PRESERVED FRUITS, JELLIES, SAUCES, ETC., BY FACTORY.		
Best display of canned fruits and vegetables, by factory	D. Johnston & Co., Cool	Diploma.
Best display of table fruits in glass, by factory	D. Johnston & Co., Cool	Diploma.
Best display of preserved fruits and jellies in glass, by factory	D. Johnston & Co., Cool	Diploma.
CLASS XI—MISCELLANEOUS.		
Best display of quinces, embracing quality and variety	Mrs. E. Shields, Sacramento	$10 00
Second best	R. C. Williamson, Auburn	5 00
Best display of pomegranates	Mrs. J. P. Odbert, Sacramento	10 00
Second best	R. C. Williamson, Auburn	5 00
For pineapple jelly	Mrs. J. P. Odbert, Sacramento	1 00
For dried fruits, not listed	Mrs. J. P. Odbert, Sacramento	1 00
For observation beehive, with queen	Irene Woods, Secramento	1 00
For fruit butters	D. Johnston & Co., Cool	Diploma.
Best display of wild fruits of ecomomic importance	Mrs. J. P. Odbert, Sacramento	$10 00
Second best	R. C. Williamson, Auburn	5 00
SPECIAL PREMIUMS IN THIS DEPARTMENT.		
For best arranged and most extensive, perfect, and varied exhibit of orchard products	Mrs. E. Shields, Sacramento	100 00
For second best	R. C. Williamson, Auburn	50 00
For third best	Mrs. J. P. Odbert, Sacramento	25 00

SEVENTH DEPARTMENT.

VITICULTURAL PRODUCTS.

Exhibit.	Exhibitor.	Award.
CLASS II—DRY WINES.		
Best white wine, Sauterne type	M. S. Jaffe, Sacramento	$10 00
Best white wine, Rhenish type	M. S. Jaffe, Sacramento	10 00
Best red wine, Burgundy type	M. S. Jaffe, Sacramento	10 00
CLASS III—SWEET WINES.		
Best California port, two years old	M. S. Jaffe, Sacramento	12 50
Best California sherry, two years old	M. S. Jaffe, Sacramento	12 50
CLASS V—SPECIAL WINES.		
Best unfermented wine	St. Helena Health Food Co.	5 00
CLASS VI—WINE GRAPES.		
Best display of wine grapes, eight varieties	Mrs. E. Shields, Sacramento	12 50
Best display, three varieties	Mrs. E. Shields, Sacramento	5 00

SEVENTH DEPARTMENT—VITICULTURAL PRODUCTS—Continued.

Exhibit.	Exhibitor.	Award.
CLASS VII—CIDER.		
Best apple cider	C. Schnerr & Co., Sacramento	$5 00
CLASS VIII—VINEGAR.		
Best pure cider vinegar	F. C. DeLong, San Francisco	5 00
Best pure wine vinegar	F. C. DeLong, San Francisco	5 00
CLASS IX—BEER.		
Best display of lager beer	Buffalo Brewing Co., Sacramento.	10 00
Best display of export beer	Buffalo Brewing Co., Sacramento.	10 00
Best display of keg beer	Buffalo Brewing Co., Sacramento.	5 00
CLASS X—MISCELLANEOUS.		
For display of Veronica mineral water	Frank Colbourn, Sacramento	Sil. Med.
For display of Pike's Peak mineral water	C. Schnerr & Co., Sacramento	Sil. Med.
For display of Crown soda water	C. Schnerr & Co., Sacramento	Sil. Med.
For display of California Tokay wine	M. S. Jaffe, Sacramento	Sil. Med.

EIGHTH DEPARTMENT.

AGRICULTURAL PRODUCTS.

Exhibit.	Exhibitor.	Award.
CLASS I—FARM PRODUCTS.		
For the most extensive, perfect, and varied exhibit	Mrs. A. Barrett, Sacramento	$100 00
Second best	Mrs. E. Shields, Sacramento	50 00
CLASS II—COTTON AND TOBACCO.		
Best display of California leaf tobacco	Mrs. E. Shields, Sacramento	15 00
Second best	A. C. Eastman, Walnut Grove	10 00
CLASS III—FLOUR AND GRAIN.		
Best display of hops	Daniel Flint, Sacramento	5 00
Best sample rye	Pacific Seed and Plant Co., Sac.	3 00
Best sample buckwheat	Pacific Seed and Plant Co., Sac.	3 00
Best sample timothy seed	Pacific Seed and Plant Co., Sac.	3 00
Best sample mesquite grass seed	Pacific Seed and Plant Co., Sac.	3 00
Best sample blue grass seed	Pacific Seed and Plant Co., Sac.	3 00
Best exhibit of alfalfa seed	Pacific Seed and Plant Co., Sac.	5 00
Best exhibit of garden seeds of California production, 25 varieties	Pacific Seed and Plant Co., Sac.	25 00
Second best	Mrs. A. Barrett, Sacramento	15 00
Best sample Australian wheat	Mrs. E. Shields, Sacramento	3 00
Best sample White Club wheat	Mrs. E. Shields, Sacramento	3 00
Best sample Sonora wheat	Mrs. E. Shields, Sacramento	3 00
Best variety of wheat in ear or head	Mrs. E. Shields, Sacramento	5 00
Best sample orchard grass seed	Mrs. E. Shields, Sacramento	3 00
Best sample White Chile wheat	Mrs. A. Barrett, Sacramento	3 00
Best sample Proper wheat	Mrs. A. Barrett, Sacramento	3 00
Best sample Chevalier barley	Mrs. A. Barrett, Sacramento	3 00
Best sample oats	Mrs. A. Barrett, Sacramento	3 00
Best sample barley	Mrs. A. Barrett, Sacramento	3 00
Best sample clover seed	Mrs. A. Barrett, Sacramento	3 00
Best sample red top seed	Mrs. A. Barrett, Sacramento	3 00
Best exhibit of yellow corn	Mrs. A. Barrett, Sacramento	5 00
Best exhibit of white corn	Mrs. A. Barrett, Sacramento	5 00
Best exhibit of sweet corn	Mrs. A. Barrett, Sacramento	5 00
Best and largest display of grain in sheaf	Mrs. E. Shields, Sacramento	40 00
Second best	A. C. Eastman, Walnut Grove	20 00

EIGHTH DEPARTMENT—AGRICULTURAL PRODUCTS—Continued.

Exhibit.	Exhibitor.	Award.
CLASS IV—VEGETABLES, ROOTS, ETC.		
Best canning and shipping tomatoes	Mrs. A. Barrett, Sacramento	$15 00
Second best	Mrs. E. Shields, Sacramento	10 00
Best and greatest variety of Irish potatoes	Mrs. A. Barrett. Sacramento	7 50
Best and greatest variety of sweet potatoes	Mrs. A. Barrett, Sacramento	5 00
Best sack of sweet potatoes	Mrs. A. Barrett, Sacramento	3 00
Best display of parsnips	Mrs. A. Barrett, Sacramento	3 00
Best display of carrots	Mrs. A. Barrett, Sacramento	3 00
Best display of blood beets	Mrs. A. Barrett, Sacramento	3 00
Best display of sugar beets	Mrs. A. Barrett, Sacramento	5 00
Best box of tomatoes	Mrs. A. Barrett, Sacramento	2 00
Best drum-head cabbage	Mrs. A. Barrett, Sacramento	2 00
Best Dutch cabbage	Mrs. A. Barrett, Sacramento	2 00
Best display of any other variety	Mrs. A. Barrett, Sacramento	2 00
Best display of cauliflower	Mrs. A. Barrett, Sacramento	2 00
Best display of broccoli	Mrs. A. Barrett, Sacramento	2 00
Best display of lettuce	Mrs. A. Barrett, Sacramento	2 00
Best display of red onions	Mrs. A. Barrett, Sacramento	2 00
Best display of yellow onions	Mrs. A. Barrett, Sacramento	2 00
Best display of white onions	Mrs. A. Barrett, Sacramento	2 00
Best display of peppers for pickling	Mrs. A. Barrett, Sacramento	2 00
Best display of roots of salsify	Mrs. A. Barrett, Sacramento	2 00
Best display of celery	Mrs. A. Barrett, Sacramento	2 00
Best display of squashes	Mrs. A. Barrett, Sacramento	5 00
Best and largest pumpkin	Mrs. A. Barrett, Sacramento	5 00
Best and largest watermelon	Mrs. A. Barrett, Sacramento	3 00
Best display of cantaloupes	Mrs. A. Barrett, Sacramento	3 00
Best display of cucumbers	Mrs. A. Barrett, Sacramento	2 00
Best display of lima beans, in pod	Mrs. A. Barrett, Sacramento	2 00
Best display of white beans, dried	Mrs. A. Barrett, Sacramento	2 00
Best display of kidney bush beans, in pod	Mrs. A. Barrett, Sacramento	2 00
Best display of green sweet corn	Mrs. E. Shields, Sacramento	2 00
Best pole beans, other than lima	Mrs. A. Barrett, Sacramento	2 00
Best display of field beans, dried	Mrs. A. Barrett, Sacramento	2 00
Best display of garden peas, dried	Mrs. A. Barrett, Sacramento	2 00
Best and greatest variety of peas, dried	Mrs. A. Barrett, Sacramento	2 00
Best display of gherkin cucumbers	Mrs. A. Barrett, Sacramento	2 00
Best display of purple egg plant	Mrs. A. Barrett, Sacramento	2 00
Best display of cañaigre roots	Mrs. A. Barrett, Sacramento	5 00
Best display of mangel-wurzels	Mrs. A. Barrett, Sacramento	5 00
CLASS V—FLOWERS.		
For most attractive general exhibit of ornamental nursery stock	H. McWilliams, Sacramento	50 00
Second best	F. A. Ebel, Sacramento	25 00
Best and largest collection of flowering plants in bloom	F. A. Ebel, Sacramento	25 00
Second best	H. McWilliams, Sacramento	15 00
Best collection ornamental foliage plants	F. A. Ebel, Sacramento	10 00
Best display of cut flowers	H. McWilliams, Sacramento	25 00
Second best	F. A. Ebel, Sacramento	15 00
Best collection of new and rare plants	F. A. Ebel, Sacramento	15 00
Best display of coleus	H. McWilliams, Sacramento	10 00
Best collection of fuchsias in bloom	F. A. Ebel, Sacramento	10 00
Second best	H. McWilliams, Sacramento	5 00
Best collection of tuberoses	F. A. Ebel, Sacramento	10 00
Second best	H. McWilliams, Sacramento	5 00
Best collection of pinks	F. A. Ebel, Sacramento	10 00
Second best	H. McWilliams, Sacramento	5 00
Best collection of ferns	H. McWilliams, Sacramento	10 00
Second best	F. A. Ebel, Sacramento	5 00
Best collection of plants suitable for greenhouse, conservatory and window culture	H. McWilliams, Sacramento	10 00
Second best	F. A. Ebel, Sacramento	5 00
Best display of hanging baskets containing plants	F. A. Ebel, Sacramento	10 00
Second best	H. McWilliams, Sacramento	5 00

Eighth Department—Agricultural Products—Continued.

Exhibit.	Exhibitor.	Award.
CLASS VI—CURED MEATS, BREAD, ETC.		
Best display of packing-house meats	D. Johnston & Co., Cool	Gold M.
Second best	Woods, Mailliard & Schmeidell, San Francisco	$15 00
Best home-cured hams	Mrs. A. Barrett, Sacramento	20 00
Second best	Mrs. E. Shields, Sacramento	10 00
Best display and best biscuit	Mrs. B. Muddox, Sacramento	2 00
Best display and best domestic wheat bread	Mrs. B. Muddox, Sacramento	2 00
Best display and best soda biscuit	Mrs. W. F. Smith, Sacramento	5 00
Best display and best domestic brown bread	Mrs. W. F. Smith, Sacramento	2 00
Best display and best domestic rye bread	Mrs. W. F. Smith, Sacramento	2 00
Best display and best graham bread	Mrs. W. F. Smith, Sacramento	2 00
Best display and best domestic bread	Mrs. W. F. Smith, Sacramento	5 00
Best display of commercial bread, crackers, biscuits, wafers, by manufacturer	St. Helena Sanitarium	Sil. Med.
CLASS VII—SUGAR, SYRUP, EXTRACTS, CONFECTIONS, AND CANDY.		
Best display of syrup made from cane	Woods, Mailliard & Schmeidell, San Francisco	$5 00
Best display of flavoring extracts	Hansen's Laboratory, San Fran.	5 00
Best general display of confectionery	Otto Kaufman, Sacramento	10 00
Best general varieties of candies made in the hall	Otto Kaufman, Sacramento	5 00
CLASS VIII—MISCELLANEOUS.		
For display of Kona coffee	J. G. Ward & Co., San Francisco	Diploma.
For display of Cero Vego	Green & Anderson, Oak Park	Diploma.
For Grandma's Spanish Pepper	J. H. Burden, Oak Park	Diploma.
For display of Breakfast Gem	C. S. Laumeister, San Francisco	Sil. Med.
For Malt Breakfast food	Malted Cereal Co., San Francisco	Diploma.
For Caramel Cereal	St. Helena Sanitarium	Sil. Med.
For granose flakes	St. Helena Sanitarium	Diploma.
For nut foods	St. Helena Sanitarium	Diploma.
For gluten meals	St. Helena Sanitarium	Diploma.
For demonstration of modern cooking	A. L. Wyman, San Francisco	Diploma.
For Postum Cereal	Woods, Mailliard & Schmeidell, San Francisco	Diploma.
For grapenut foods	Woods, Mailliard & Schmeidell, San Francisco	Diploma.
For most meritorious exhibit	Mrs. A. Barrett, Sacramento	$25 00

NINTH DEPARTMENT.

FINE ARTS.

Exhibit.	Exhibitor.	Award.
CLASS I—OIL PAINTINGS, WATER COLORS, CRAYONS, CHARCOAL, AND PASTELS.		
Twelve oil paintings	H. R. Bloomer, San Francisco	$25 00
Five oil paintings	M. Straus, San Francisco	12 00
Five oil paintings	Bertha Lee, San Francisco	12 00
Four oil paintings	H. S. Fonda, San Francisco	12 00
Seven oil paintings	M. E. Nicholl, San Francisco	9 00
Six oil paintings	Mrs. Menton, San Francisco	12 00
One oil painting	Mary Brady, San Francisco	7 00
Four oil paintings	Maren Frolich, San Francisco	12 00
Seven oil paintings	E. W. Currier, San Francisco	7 00
Four oil paintings	Jules Pages, San Francisco	7 00

Ninth Department—Fine Arts—Continued.

Exhibit.	Exhibitor.	Award.
CLASS I—OIL PAINTINGS, WATER COLORS, CRAYONS, CHARCOAL, AND PASTELS.		
Seventeen oil paintings	C. Jonnevold, San Francisco	$16 00
Five oil paintings	J. E. Gamble, San Francisco	16 00
Three oil paintings	G. Cadenasso, San Francisco	12 00
Four oil paintings	M. Patterson, San Francisco	9 00
Two oil paintings	Mary E. Bruenn, Oakland	7 00
Two oil paintings	Ethel Wickes, San Francisco	7 00
Three oil paintings	K. Thompson, San Francisco	5 00
Three oil paintings	Paul Memegowena, San Francisco	5 00
Three oil paintings	A. W. Best, San Francisco	9 00
Five oil paintings	De Frasse, San Francisco	7 00
Twelve oil paintings	Annie Harmon, San Francisco	12 00
Seventeen oil paintings	J. A. Stanton, San Francisco	44 00
Four oil paintings	C. A. Rogers, San Francisco	7 00
Four oil paintings	Kate Maher, San Francisco	7 00
Three oil paintings	R. D. Yelland, San Francisco	16 00
Three oil paintings	Josephine Eckler, San Francisco	9 00
Five oil paintings	Mabel Williamson, San Francisco	9 00
Three oil paintings	Nellie B. Scott, San Francisco	9 00
One oil painting	Orrin Peck, San Francisco	12 00
Four oil paintings	Harry W. Sewell, San Francisco	12 00
Four oil paintings	C. Turner, San Francisco	7 00
Three oil paintings	C. Dickman, San Francisco	9 00
Two oil paintings	Grace Hudson, San Francisco	9 00
Seven oil paintings	Granville Redmond, San Francisco	12 00
Eight oil paintings	W. F. Jackson, Sacramento	20 00
Four oil paintings	A. P. Hill, San Francisco	11 00
Two oil paintings	Ethel Clement, San Francisco	7 00
Three oil paintings	S. S. Loosley, San Francisco	12 00
Two oil paintings	R. Mocine, San Francisco	5 00
One oil painting	A. Joullin, San Francisco	7 00
Five oil paintings	Alice Chittenden, San Francisco	16 00
One oil painting	Minnie Kleinsorge, Sacramento	7 00
Four oil paintings	Miss J. L. Huber, Berkeley	8 00
Two oil paintings	T. H. Thompson, Alameda	5 00
Three oil paintings	Josephine Blanche, Sacramento	5 00
Four oil paintings	Isabel Porter, San Francisco	12 00
Four oil paintings	J. R. McElroy, San Francisco	7 00
Two oil paintings	W. L. Judson, Los Angeles	9 00
Four oil paintings	Helen E. Coan, Oakland	12 00
One oil painting	Grace Witherell, Oakland	7 00
Two oil paintings	De Neale Morgan, Oakland	12 00
Two oil paintings	H. D. Gremke, Oakland	8 00
One oil painting	N. A. Bradshaw, Oakland	3 00
One oil painting	J. E. Cowles, Los Angeles	7 00
Four pastels	Blanche Letcher, San Francisco	12 00
Two pastels	Oscar Kunath, San Francisco	12 00
One pastel	Annie F. Briggs, Oakland	7 00
Two pastels	G. Loring, San Francisco	5 00
Two water colors	Alice M. Best, San Francisco	7 00
Seventeen water colors	C. P. Neilson, Alameda	S.M.&$16
Six water colors	A. F. Briggs, San Francisco	$9 00
Two water colors	K. C. Thompson, San Francisco	3 00
Seven water colors	Pauline Dworzek, San Francisco	12 00
Four water colors	F. McClatchy-Richardson, S. F.	7 00
Two water colors	Edith Whitefield, San Francisco	5 00
Three water colors	E. H. Berwick, San Francisco	5 00
Three water colors	Martha Johnson, San Francisco	5 00
Six water colors	H. McCartney, San Francisco	8 00
Four water colors	Adelaide Hanscom, San Fran.	7 00
Two water colors	Eliza Gremke, Oakland	5 00
Three water colors	Calthea Vivian, San Francisco	9 00
Three water colors	Frank T. Stone, Los Angeles	7 00
Six water colors	Mrs. A. C. Herrick, Sacramento	7 00
Three water colors	Sophia T. Palmer, San Francisco	5 00

Ninth Department—Fine Arts—Continued.

Exhibit.	Exhibitor.	Award.
CLASS II—PHOTOGRAPHS.		
Display of photographs	J. W. Bird, Sacramento	$5 00
Display of amateur photographs	W. A. Gill, Oakland	3 00
Display of amateur photographs	Ernest Ferriter, Sacramento	3 00
Display of photographs	J. A. Walker, Sacramento	12 00
Display of photographs	B. M. Hodson, Sacramento	10 00
Display of amateur photographs	F. M. Braddock, Sacramento	5 00
Display of amateur photographs	W. E. Cogswell, Sacramento	4 00
Display of amateur photographs	Laura Adams, San Francisco	S.M. & $5
Display of photographs	L. M. Downing, San Francisco	$3 00
CLASS III—ETCHINGS, INDIA INK, PEN AND PENCIL DRAWINGS.		
Four pen and ink sketches	Isabell Porter, San Francisco	15 00
Five pen and ink sketches	R. Mocine, San Francisco	8 00
One pen and ink sketch	S. P. Palmer, San Francisco	4 00
Three pen and ink sketches	Josephine Eckler, San Francisco	5 00
Two pen and ink sketches	J. L. Brothers, San Francisco	4 00
Five pen and ink sketches	Mrs. Jos. Davis, San Francisco	5 00
Four pen and ink sketches	Miss F. Weiger, Sacramento	2 00
One pen and ink sketch	C. Dickman, San Francisco	2 00
Two pen and ink sketches	G. Redmond, San Francisco	5 00
CLASS IV—STATUARY, FRESCO, MOSAIC, AND CARVED WORK.		
Six pieces of statuary	Frank F. Stone, Los Angeles	14 00
One piece of statuary	F. Peano, Oakland	11 00
Three pieces of statuary	M. P. Neilson, San Francisco	S.M.&$25
CLASS V—PENMANSHIP.		
Most meritorious display of penmanship	Howe's Academy, Sacramento	Sil. Med.
Best sample of penmanship	C. N. Faulk, Sacramento	$5 00
CLASS VII—CALIFORNIA DRAWINGS AND DESIGNS.		
Best mechanical and free-hand drawing	J. Fred Schultz, Sacramento	Sil. Med.
Best drawing or example of applied ornament in classic architecture	A. W. Campbell, Sacramento	Sil. Med.
Best plan or design of city residence	E. M. Hoen, Sacramento	Sil. Med.
Best display of mechanical or geometrical free-hand penmanship by any class in a school of design	Sacramento Free Night School	$20 00
Best drawing or display of one or more of the classic orders of architecture	Rudolph A. Herold, Sacramento	Sil. Med.
Best display of mechanical or geometrical free-hand penmanship by any class in a commercial or business college	Howe's Academy, Sacramento	Sil. Med.

GOLD MEDAL.

To Hale Bros. & Co., for the most attractive and artistically designed display in the Pavilion.

DEPARTMENT GOLD MEDALS.

FIRST DEPARTMENT.

To C. A. Durfee, for meritorious exhibition of thoroughbred horses.
To G. T. Hennagin, for meritorious exhibition of draft horses.
To Jos. Marzen, for meritorious exhibition of Shorthorn and Hereford cattle.

SECOND DEPARTMENT.

To A. Meister & Sons, for most meritorious exhibition of carriages, buggies, etc.

THIRD DEPARTMENT.

To Weinstock, Lubin & Co., for most meritorious exhibition of textile fabrics.

FOURTH DEPARTMENT.

To Holbrook, Merrill & Stetson, for meritorious exhibition of mechanical products.

SIXTH DEPARTMENT.

To Mrs. E. Shields, for most meritorious exhibition of horticultural products.

SEVENTH DEPARTMENT.

To Buffalo Brewing Co., for most meritorious exhibition of beer and ice.

EIGHTH DEPARTMENT.

To Mrs. A. Barrett, for most meritorious exhibition of agricultural products.

NINTH DEPARTMENT.

To John A. Stanton, for most meritorious exhibition of fine arts.

SPECIAL GOLD MEDALS.

To J. H. Glide, for meritorious exhibition of Ramboulette sheep.
To D. Johnston & Co., for meritorious display of packing-house meats.
To D. Johnston & Co., for best preserved fruits and jellies in glass, by manufacturer.
To Joshua Hendy Machine Works, for meritorious exhibition of dairy machinery.
To Mrs. Fannie F. Spaulding, for meritorious exhibition of decorative painting.

SPEED PROGRAMME.

MONDAY, SEPTEMBER 3, 1900.

RACE NO. 1—TROTTING.

Occident Stake for 1900; for foals of 1897. Mile heats, three in five. Entries closed January 1, 1898. $100 entrance, of which $10 accompanied nomination; $15 paid January 1, 1899; $25 paid January 1, 1900; and $50 thirty days before the race. The Occident Cup, of the value of $400, to be added by the Society. First colt to receive cup and six tenths; second colt, three tenths; and third colt, one tenth of the stakes. Five to enter, three to start, otherwise N. T. A. Rules to govern. Closed with fifty-seven entries, of which five made final payment of $50 each. Total paid in, $1,830.

1. La Siesta Ranch's (San José) b. g. The Roman, by McKinney—Wanda.
2. Hogoboom & Kingsbury's (Marysville) b. f. Eulah Mc, by McKinney—Balance All.
3. E. P. Heald's (San Francisco) br. c. Tom Smith, by McKinney—Daisy S.
4. Vendome Stock Farm's (San José) b. c. Vendome, by Iran Alto—Lynda Oak.

SUMMARY.

Eulah Mc (W. Hogoboom)	4	1	1	1
Tom Smith (J. L. Smith)	2	2	2	2
The Roman (E. Lafferty)	1	dis.		
Vendome (C. T. Bunch)	3	dis.		

Time—2:19, 2:17½, 2:22½, 2:22¼.

RACE NO. 2—PACING.

Green class. Purse, $600. Mile heats, three in five.

1. D. Hinds's (Alameda) g. m. The Queen, breeding unknown.
2. R. P. Greeley's (Oakland) ch. m. Maud R, by Jim C—Perfection Bell.
3. J. Sangster's (Fresno) b. m. Jennie S, by Directum—Dam by Nephew.
4. George Gray's (Haywards) b. g. Enoch, by Sidmoor—Belle.
5. Vendome Stock Farm's (San José) ch. g. Fredericksburg, by Nephew, Jr.—Minnie Hubbard.
6. W. G. Durfee's (Los Angeles) ch. m. Cleon, by Happy Prince—Dam by Inca.
7. Mrs. C. B. Bigelow's (Woodland) b. m. Tags, by Diablo—Bonnie B.
8. A. B. Spreckels's (San Francisco) g. g. Mulcahy, by Aptos Wilkes—Mulkey mare.
9. J. M. Lipson's (San Bernardino) br. h. Zaloch, by McKinney—Gazelle.

SUMMARY.

Tags (C. B. Bigelow)	1	1	1
Enoch (B. Simpson)	7	2	2
Jennie S (J. Sangster)	2	4	4
Fredericksburg (C. T. Bunch)	3	5	3
Cleon (W. G. Durfee)	4	7	dr.
The Queen (J. Nelson)	5	3	5
Maud R (J. Shaner)	6	6	dis.
Mulcahy (C. D. Jeffries)	dis.		
Zaloch (J. Donahue)	dis.		

Time—2:15½, 2:16½, 2:20¼.

RACE NO. 3—RUNNING.

For three-year-olds and upward. Six furlongs. Selling. Purse $300, of which $50 to second and $25 to third. Winner to be sold for $600. 5 lbs. below the scale. For horses entered in the Flash, Dewey, or Vinctor stakes. Horses that have not won a stake race or five races of any value in 1900, allowed 7 lbs.; or of three races in 1900, 10 lbs.; or of any race in 1900, 15 lbs. Entrance fee of $10 to go to the winner.

1. W. B. Sink, Jr.'s, ch. h. Formero (4), by Imp. Conveth—Formosa; 110 lbs.
2. Gill Summers's ch. g. Herculean (3), by Imp. Watercress—Hana; 96 lbs.
3. J. S. Gibson's ch. m. February (a), by St. Carlo—Sister to Ruth Ryan; 99 lbs.
4. The Abbey Stable's b. m. Jennie Reid (4), by El Rio Rey—Fonsetta; 107 lbs.
5. W. M. Murry's br. g. Casdale (4), by Faverdale—Castalia; 107 lbs.
6. J. Crane's b. g. Amasa (5), by Capt. Al—Lady Intruder; 107 lbs.
7. W. L. Stanfield's ch. g. Toribio (5), by Apache—Marin; 117 lbs.

SUMMARY.

Formero (Ruiz)	1
Toribio (Ames)	2
February (McDonald)	3

Time—1:13¾.

Race No. 4—Running.

For two-year-olds. Five furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $500. 5 lbs below the scale. A non-winner of a stake race, if a non-winner of three races, allowed 5 lbs.; of two races and maidens, 7 lbs.; beaten maidens, 12 lbs.

1. W. B. Jennings & Co.'s br. c. Canmore (2), by Imp. Midlothian—Fannie Louise; 106 lbs.
2. Burns & Waterhouse's b. f. Spainwar (2), by Imp. Artillery—Sweet Rose; 103 lbs.
3. Elmwood Farm's ch. c. Illilouon (2), by Tiger—Gipsette; 106 lbs.
4. Thos. Fox's br. f. Screenwell Lake (2), by Imp. Artillery—Lake County; 103 lbs.
5. J. Foley's ch. f. Miss Bessie Shanley (2), by Bright Phœbus—Marinette; 103 lbs.
6. A. J. Stemler & Co.'s ch. f. Eonic (2), by Eon—Mermaid; 105 lbs.
7. Gill Summers's b. f. Bavassa (2), by Imp. Bassetlaw—Bavaria; 103 lbs.
8. W. M. Murry's b. f. Carilee (2), by St. Carlo—Marilee; 98 lbs.

SUMMARY.

Bavassa (Mounce)	1
Eonic (Farrell)	2
Spainwar (Butler)	3

Time—1:01¾.

Race No. 5—Running.

For three-year-olds and upward. Seven furlongs. Selling. Purse $250, of which $50 to second and $25 to third. For horses that have not won two races in 1900. Winner to be sold for $1,000; if for less, 3 lbs. allowed for each $100 down to $300. Maidens and horses not having won any race in 1900 allowed 5 lbs. Beaten non-winners and beaten maidens allowed 10 lbs. Entrance fee of $10 to go to the winner.

1. L. McArthur's b. g. Pilot (3), by Morello—Adelante; 95 lbs.
2. J. Weber's b. g. Abano (4), by Imp. Creighton—Glee; 110 lbs.
3. Elmwood Farm's br. g. Meadow Lark (a), by Imp. Brutus—Nabette; 104 lbs.
4. J. J. O'Malley's ch. m. Torsida (5), by Torso—Judith; 101 lbs.
5. C. Spooner's ch. g. Don Luis (5), by Imp. Midlothian—Alameda; 97 lbs.
6. A. J. Stemler & Co.'s ch. g. Lodestar (a), by Imp. Midlothian—Starlight; 107 lbs.
7. W. B. Jennings & Co.'s b. c. Anjou (3), by St. Andrew—Jude; 104 lbs.
8. J. Martin, Jr.'s b. m. Petal (5), by Oscar—Little Rose; 91 lbs.
9. J. Touhey & Co.'s blk. h. Brierhill (5), by Imp. Duncombe—Brierbush; 102 lbs.
10. J. Dunn's b. g. Jack McCabe (4), by Capt. Al—Myrtle G; 91 lbs.
11. Owen Bros.' ch. f. Flush of Gold (3), by Royal Flush—Gold Cup; 92 lbs.
12. W. M. Murry's b. g. Kickumbob (3), by Imp. Idalium—Maria F; 85 lbs.
13. Matt Storn's b. g. Sunello (3), by Morello—Sunlit; 104 lbs.
14. E. Lloyd & Co.'s ch. g. Caesar Young (3), by Hanover—Mollie Seabrook; 85 lbs.
15. J. Sullivan's b. m. Glen Ann (5), by St. Andrew—Glencola; 104 lbs.

SUMMARY.

Lodestar (Farrell)	1
Flush of Gold (Stuart)	2
Abano (Ruiz)	3

Time—1:28¼.

TUESDAY, SEPTEMBER 4, 1900.

RACE NO. 6—PACING.

For three-year-olds and under (2:20 class). $50 entrance; $300 added by the Society. Closed May 15th with nine entries, of which three made final payment. Total paid in, $240.

1. J. A. Cumming's (Woodland) blk. g. The Boer, by Waldstein—Belle Button.
2. C. A. Owen's (Fresno) b. g. Dakan D, by Athadon—Zadie McGregor.
3. I. L. Borden's (San Francisco) ch. g. N L B, by Diablo—Alice Bell.

SUMMARY.

Dakan D	1	1	1
N L B	2	2	2
The Boer	dis.		

Time—2:25, 2:26, 2:23.

RACE NO. 7—TROTTING.

2:24 class. Purse, $1,000. Mile heats, three in five.

1. Wm. Morgan's (Pasadena) b. m. Una K, by McKinney—Unknown.
2. James Coffin's (San Francisco) br. g. Puerto Rico, by Sable Wilkes—Mamie Kohl.
3. J. D. Carr's (Salinas) b. h. Silvian, by Electricity—Lucky Girl.
4. W. H. Grissim's (Vallejo) b. h. Joe Selby, by Don L—The Kingsley Mare, by Echo.
5. S. C. Tryon & Co.'s (Sacramento) b. m. Princess Wilkes, by Clarence Wilkes—Dam by Dexter Prince.
6. R. E. Mulcahy's (San Francisco) b. m. Algonita, by Eros—Algonette.
7. Chas. Raisch's (Marysville) br. m. Cyclone, by Brigadier.
8. C. P. Chamberlain's (Rossland, B. C.) g. g. Greyling, by Hambletonian Mambrino—Lady Grey.
9. C. W. Hamerton's (Oakland) b. g. General Smith, by Don Lowell—Dam by Brigadier.
10. Rose Dale Stock Farm's (Santa Rosa) b. m. Julia S, by Daly.
11. Mrs. Wm. Proctor's (Woodland) —— ——.
12. G. Y. Bollinger's (San José) b. m. Belle Patchen, by Alto Rex—Last Chance.
13. H. W. Meeks's (San Lorenzo) b. m. Janice, by Wm. Harold—Fenella.
14. P. W. Hodges's (Los Angeles) b. m. Atherine, by Patron—Dam by Harold.
15. H. H. Hellman's (San José) ch. g. Juan Chico, by Bay Rum—Flora.
16. W. G. Durfee's (Los Angeles) blk. g. Charlie Mc, by McKinney—Dam by Doncaster.

SUMMARY.

Janice (B. Sampson)	5	2	1	8	1	2	1
Charlie Mc (W. G. Durfee)	1	3	7	4	2	1	2
General Smith (J. Shaner)	2	1	2	2	5	4	4
Belle Patchen (F. Ward)	4	4	4	1	3	3	3
Juan Chico (H. Hellman)	6	6	3	7	4	r. o.	
Puerto Rico (J. Cucello)	10	7	6	3	6	r. o.	
Algonita (J. Nelson)	9	8	5	5	7	r. o.	
Julia S (W. Hogoboom)	7	9	8	6	dis.		
Greyling (L. Childs)	3	5	dis.				
Joe Selby (J. L. Smith)	8	dis.					
Silvian (J. Dwain)	dis.						
Atherine (P. W. Hodges)	dr.						

Time—2:19, 2:19½, 2:19½, 2:19, 2:19, 2:21.

RACE NO. 8—RUNNING.

Flash Stake; for all ages. Six furlongs. Entrance $10, to accompany nomination; $20 additional for horses not declared by 4 P. M. the day preceding the race; $400 added by the Society, of which $70 to second and $30 to third. Non-winners of five races this year, if three-year-olds and over, and a non-winner of a race in 1899 or 1900 of the value of $1,000, allowed 5 lbs.; or of one of the value of $600, 10 lbs.; of $400, 15 lbs. Maidens, three years old allowed 5 lbs.; four years old and over, 7 lbs. additional. Closed with twenty-eight entries. Value of stake, $880.

1. Gill Summers's b. f. Torsina (a), by Torso—Bavaria; 104 lbs.
2. J. S. Gibson's ch. m. February (6), by St. Carlo—Sister to Ruth Ryan; 104 lbs.
3. Elmwood Farm's b. c. Constellator (3), by Imp. Brutus—Constellation; 106 lbs.
4. The Abbey Stable's ch. m. Mocorito (5), by Amigo—Santa Monica; 104 lbs.
5. W. L. Appleby & Co.'s ch. g. True Blue (6), by Duke of Norfolk—Carmen; 122 lbs.

6. Burlingame Stock Farm's ch. h. Magnet (a), by St. Blaise—Magnetic; 107 lbs.
7. W. B. Jennings & Co.'s b. f. Asian (3), by Imp. Goldfinch—Lydia; 101 lbs.
8. Burns & Waterhouse's b. f. Bee Bee (3), by Imp. St. Andrew—Free Love; 98 lbs.
9. J. Dunn's b. g. Pompino (4), by Puryear D—Sweet Peggy; 107 lbs.
10. G. Brown's b. m. Mabel L (a), by Major Ban—Acquito; 97 lbs.

SUMMARY.

Torsina (Mounce)	1
Magnet (Walker)	2
True Blue (Appleby)	3

Time—1:13.

Race No. 9—Running.

For three-year-olds and over. One and one-sixteenth miles. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $700; if for less, 3 lbs. on each $100 down to $200. Winners of three or more races this year not to be entered for less than $400. Maidens allowed 7 lbs. Entrance fee of $10 to go to the winner.

1. W. M. Murry's ch. g. Cromwell (a), by St. Blaise—Flavina; 107 lbs.
2. Matt Storn's b. m. Morinel (4), by Morello—Sunlit; 110 lbs.
3. J. J. Grant's b. f. Princess Zeika (3), by Rey del Sierra—Countess Zeika; 94 lbs.
4. Pete Smith's ch. g. Expedient (3), by Flambeau—Experiment; 103 lbs.
5. Owen Bros.' b. h. Grady (a), by Three Cheers—Gold Cup; 107 lbs.
6. Dan Morgan's b. g. McFarlane (a), by Mariner—Moonlight; 107 lbs.
7. M. A. Forster's b. g. Rey del San Juan (4), by Dan M. Murphy—Zingerella; 115 lbs.
8. Budd Doble & Co.'s b. g. El Mido (4), by Sir Modred—Ethel; 110 lbs.

SUMMARY.

Morinel (Powell)	1
El Mido (Shaw)	2
Cromwell (Mounce)	3

Time—1:47½.

Race No. 10—Running.

For maiden three-year-olds and over. Six furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $300. All to carry 107 lbs.; no sex allowance. Maidens beaten three or more times this year allowed 5 lbs. Entrance fee of $10 to go to the winner.

1. Chas. Quick's br. g. Artilleryman (3), by Artillery—Clara L; 102 lbs.
2. Martin Duffy's b. h. Phlegon (3), by Imp. Piccolo—Little Rose; 107 lbs.
3. Elmwood Farm's b. f. Letiger (3), by Tiger—Letitia; 102 lbs.
4. W. M. Murry's b. g. Only Me (5), by Prince Royal—Imp. Manzanita; 107 lbs.
5. John Rector's b. m. Miss Vera (3), by Amigo—Fame; 107 lbs.
6. A. B. Spreckels's b. m. Nihau (5), by St. Savior—Yarranabee; 107 lbs.
7. Alameda Stable's b. g. Trevathan (3), by Bassetlaw—Mercedes; 107 lbs.
8. C. P. Fink's b. f. Swiftwater (3), by Imp. Candlemas—Ripletta; 102 lbs.
9. M. T. Walters's ch. f. Della Connor (4), by Connor—Della Walker; 107 lbs.

SUMMARY.

Artilleryman (McDonald)	1
Letiger (Butler)	2
Trevathan (Ruiz)	3

Time—1:14¾.

Race No. 10a—Polo Pony Race.

Distance, one fourth mile. Purse, $100. $5 each entrance money, to go to second horse. Gentlemen riders. Owners' handicap. Minimum weight, 155 lbs.

1. F. J. Carolan's (Burlingame) ch. m. Princess Flavia; 155 lbs.
2. C. Dunphy's (Burlingame) b. m. Lady Betty; 155 lbs.
3. W. S. Hobart's (Burlingame) ch. m. Slats; 155 lbs.
4. M. A. Forster's (Los Angeles) ch. m. Julia; 155 lbs.

SUMMARY.

Slats	1
Julia	2
Princess Flavia	3

Time—0:23¼.

WEDNESDAY, SEPTEMBER 5, 1900.

RACE NO. 11—PACING.

2:25 class. Purse, $1,000. Mile heats, three in five.

1. George A. Davis's (Pleasanton) blk. h. Rey Direct, by Direct—Vera.
2. E. C. Frisbie's (Marysville) ch. m. May B, by Coats' Brigadier—Dolly.
3. Mrs. H. C. Myers's (Fresno) b. m. Easter D, by Easter Wood—Lottie Lee.
4. Nutwood Stock Farm's (Irvington) b. m. Georgie B, by Nutwood Wilkes—Maggie.
5. S. Layng's (San Francisco) b. g. Sir Albert S, by Diablo—Effie Logan.
6. A. P. Meredith's (Tombstone) br. h. Wopolo, by Tom Hal, Jr.—Dollie M.
7. I. L. Borden's (San Francisco) ch. c. Robert I, by Hambletonian Wilkes—Anna Belle.
8. P. W. Hodges's (Los Angeles) b. m. Queen R, by Redondo—Dam by Adrian Wilkes.
9. W. S. Maben's (Los Angeles) blk. m. Santa Anita Maid, by Guy Wilkes—Dam by Sultan.
10. Ben Rush's (Suisun) b. h. Demonia, by Chas. Derby—Bertha.
11. G. Y. Bollinger's (San José) ch. m. Our Boy's Sister, by Baywood—Nellie Bly.
12. S. C. Tryon & Co.'s (Sacramento) blk. m. Margaretta, by Direct—Rosita A.
13. G. Trank's (Chico) b. g. Harry J, by Reavis's Steinway—Jennie June.
14. A. W. Breuner's (Sacramento) ch. h. Stanton Wilkes, by Nutwood Wilkes—Eva.

SUMMARY.

Queen R (P. W. Hodges)	1	1	1
Stanton Wilkes (J. T. Donnelly)	2	2	4
Georgie B (W. Cecil)	4	4	2
Santa Anita Maid (W. S. Maben)	5	3	3
Rey Direct (E. Parker)	3	dis.	
Our Boy's Sister (C. Hill)	6	dis.	

Time—2:14½, 2:12¼, 2:16½.

RACE NO. 12—TROTTING.

2:10 class. Purse, $800. Mile heats, three in five.

1. George T. Becker's (Los Angeles) br. h. Zombro, by McKinney—Whisper.
2. Santa Rosa Stock Farm's (Santa Rosa) b. m. Dolly Dillon, by Sidney Dillon—Dolly.
3. Tuttle Bros.'s (Rocklin) b. h. Stam B, by Stamboul—Belle Medium.
4. T. J. Crowley's (San Francisco) blk. g. Addison, by James Madison—Dam by Berlin.
5. Mrs. S. V. Barstow's (San José) b. g. Claudius, by Nutwood Wilkes—Fanny Menlo.
6. Hogoboom & Kingsbury's (Marysville) b. g. Daimont, by Lynmont—Daisy.
7. L. E. Clawson's (San Francisco) b. m. Phœbe Childers, by Sir Roderick—Martha Washington.
8. J. B. Iverson's (Salinas) br. g. Prince Gift, by Good Gift—Belle.
9. P. W. Hodges's (Los Angeles) b. m. Hazel Kinney, by McKinney—Baby Gift.

SUMMARY.

Dolly Dillon (M. Sanders)	4	1	1	1
Phœbe Childers (G. Lapham)	1	3	4	3
Claudius (T. V. Barstow)	2	2	3	4
Hazel Kinney (P. W. Hodges)	3	4	2	2

Time—2:13, 2:13¾, 2:12½, 2:12½.

RACE NO. 13—RUNNING.

Shafter Selling Stake. Six furlongs. For maiden two-year-olds at the time of closing the stake. Entrance $10, to accompany nomination; $15 additional for colts not declared by 4 P. M. day preceding race; with $300 added by the Society, of which $50 to second and $25 to third. Horses may be entered not to be sold, and carry rule weight. If entered to be sold for $1,000, allowed 3 lbs.; $700, 6 lbs.; $400, 10 lbs. Winners of one race after closing of stake to carry 3 lbs. extra; of two or more, 7 lbs. extra. Maidens beaten three times, allowed 5 lbs; four or more, 7 lbs. Closed with twenty-four entries. Value of stake, $660.

1. W. C. de B. Lopez's b. c. Articulate (2), by Imp. St. Andrew—Imp. Utter; 111 lbs.
2. Thomas Fox's b. c. Phil Archibald (2), by Imp. Artillery—Flossy; 105 lbs.
3. Atkins & Lottridge's b. f. Location (2), by Imp. Prospector—Venezia; 98 lbs.
4. J. H. Dolan's ch. f. Maresa (2), by Imp. True Briton—Mazette; 105 lbs.

5. Burns & Waterhouse's b. f. Spainwar (2), by Imp. Artillery—Sweet Rose; 105 lbs.
6. A. J. Stemler & Co.'s b. f. Lily Andrew (2), by Imp. St. Andrew—Hot Springs; 105 lbs.
7. Matt Storn's blk. g. Cambaceres (2), by Imp. Idalium—Imp. Candid; 105 lbs.
8. W. B. Jennings & Co.'s b. c. Canmore (2), by Imp. Midlothian—Fannie Louise; 108 lbs.

SUMMARY.

Lily Andrew (Farrell) -------- 1
Maresa (Butler) -------- 2
Phil Archibald (Frawley) -------- 3

Time—1:15.

RACE NO. 14—RUNNING.

For three-year-olds and over that have not won more than two races in 1899 and 1900. Six furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold at auction for $300. 10 lbs. below scale. Beaten maidens allowed 5 lbs. Entrance fee of $10 to go to the winner.

1. W. M. Murry's br. g. Kickumbob (3), by Imp. Idalium—Maria F; 106 lbs.
2. L. McArthur's b. g. Pilot (3), by Morello—Adelante; 106 lbs.
3. S. Judge & Co.'s b. f. Uppercrust (3), by Prince Royal—Undercrust; 103 lbs.
4. T. F. Lynch's ch. h. Ko Ko (6), by Jackson—Minnie B; 112 lbs.
5. E. B. Smith's br. m. Wing (4), by Dundee—Beaswing; 109 lbs.
6. Alameda Stable's b. f. Lobosina (3), by Golden Garter—Tremblor; 98 lbs.
7. A. B. Spreckels's ch. m. Ulloa (4), by Imp. Creighton—Imp. Zara; 109 lbs.
8. J. Touhey & Co.'s blk. h. Brierhill (5), by Duncombe—Brierbush; 112 lbs.

SUMMARY.

Pilot (Butler) -------- 1
Brierhill (McNichols) -------- 2
Kickumbob (Gaffney) -------- 3

Time—1:15.

RACE NO. 15—RUNNING.

For three-year-olds and over that have not won more than two races in 1899 and 1900. Six furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold at auction for $300. 10 lbs. below scale. Beaten maidens allowed 5 lbs. Entrance fee of $10 to go to the winner.

1. Owen Bros.' ch. f. Flush of Gold (3), by Royal Flush—Gold Cup; 103 lbs.
2. A. J. Stemler & Co.'s b. h. Lou Rey (4), by El Rio Rey—Louise M; 112 lbs.
3. W. B. Jennings & Co.'s ch. c. Redwald (3), by Tenny—Imp. Redworth Rose; 106 lbs.
4. J. Martin, Jr.'s b. m. Petal (5), by Oscar—Little Rose; 109 lbs.
5. P. E. Smith's ch. h. Alturas (a), by Shannon—Avondale; 112 lbs.
6. J. McCarty's b. g. Almoneer (4), by Imp. Midlothian—Charity; 112 lbs.
7. W. R. Larzelere's b. g. St. Anthony (3), by St. Andrew—Half Sister; 106 lbs.
8. J. J. O'Malley's ch. m. Torsida (5), by Torso—Judith; 109 lbs.

SUMMARY.

Almoneer (McCarty) -------- 1
Redwald (Ames) -------- 2
Alturas (Collis) -------- 3

Time—1:14.

RACE NO. 15A—POLO PONY RACE.

Pacific Coast Pony Championship Cup. Distance, one half mile. Purse, $250 and silver cup presented by Prince Poniatowski. Entrance, $10 each, to go to second horse. Gentlemen riders. Minimum weight, 155 lbs. For ponies having been placed first, second, or third at the Monterey or Sacramento polo races, 1900. The cup to be won twice by the same pony at the State Agricultural Fair before it becomes the property of the winner.

1. C. Dunphy's (Burlingame) s. m. Lady Betty (a); 155 lbs.
2. M. E. Flowers's (Riverside) ch. m. Viola (a); 155 lbs.
3. F. J. Carolan's (Burlingame) ch. c. Fusilade (a); 155 lbs.
4. W. S. Hobart's (Burlingame) ch. m. Slats (a); 155 lbs.

Lady Betty (Mr. Dunphy) -------- w. o. for cup.

THURSDAY, SEPTEMBER 6, 1900.

Race No. 16—Pacing.

2:11 class. Purse, $1,000. Mile heats, three in five.

1. Charles Kapp's (San Francisco) b. s. I. Direct, by Direct—Francesca.
2. A. M. Waldon's (Sacramento) b. h. Dave Ryan, by Antevolo—Network.
3. S. C. Tyron & Co.'s (Sacramento) ch. h. Daedalion, by Diablo—Dam by Buccaneer.
4. D. Hinds's (Alameda) br. h. John A, by Wayland W—Lady Moore.
5. A. L. Conklin's (Bakersfield) b. m. Edna R, by Sidney—Dam by Director.
6. J. B. Iverson's (Salinas) ch. m. Dictatress, by Dictatus—Salinas Belle.
7. H. W. Meek's (San Lorenzo) b. h. Wm. Harold, by Sidney—Cricket.
8. John Snover's (Santa Ana) b. m. Floracita, by Red Cloak—Maggie H.
9. H. H. Hellman's (San José) b. m. Myrtha Whips, by Whips—Myrtha.
10. S. H. Hoy's (Winters) b. g. Kelly Briggs, by Bayswater Wilkes—Dam by Algona.
11. P. Henshaw's (Chico) b. g. Fitz Lee, by Arthur Wilkes—Lady Merrill.
12. R. H. Hanscom's (Fresno) b. h. Goshen Jim, by Moses S—Dam by Brown Tempest.

SUMMARY.

Kelly Briggs (S. H. Hoy)	5	1	1	1
Myrtha Whips (H. Hellman)	1	2	3	2
I. Direct (E. Lafferty)	2	3	5	4
Daedalion (W. Tyron)	4	5	2	3
Edna R (F. Trainer)	3	4	4	5
Wm. Harold (G. Gray)	6	6	6	6
Floracita (G. Judd)	7	dis.		
Goshen Jim (S. Eddy)	dis.			
Dictatress (C. Rodriguez)	dis.			

Time—2:11½, 2:11½, 2:12½, 2:14¼.

Race No. 17—Trotting.

2:15 class. Purse, $1,000. Mile heats, three in five.

1. Walter Masten's (Woodland) b. g. Hobo, by Arthur Wilkes—Dam by a son of Blackbird.
2. Santa Rosa Stock Farm's (Santa Rosa) b. m. Bonsaline, by Stamboul—Bon Bon.
3. A. B. Spreckels's (San Francisco) b. m. Psyche, by Cupid—Emma S.
4. D. Hinds's (Alameda) b. h. Alta Vela, by Electioneer—Loretta.
5. A. W. Breuner's (Sacramento) br. g. El Moro, by Longworth—Dam by Anteeo.
6. Hogoboom & Kingsbury's (Marysville) ch. g. Lynall, by Lynmont—Balance All.
7. Alex. Brown's (Walnut Grove) br. m. Lottie, by San Diego—Dam by Whippleton.
8. W. G. Durfee's (Los Angeles) b. h. Osito, by McKinney—Twilight.
9. Nutwood Stock Farm's (Irvington) b. g. Bob Ingersoll, by Nutwood Wilkes—Lou G.
10. H. Boone's (Bodie) ch. g. Arrow, by Silver Bow—Maud W. W.

SUMMARY.

El Moro (C. E. Clark)	4	4	1	1	1
Arrow (H. Willis)	7	1	5	3	2
Lottie (H. Spencer)	2	2	8	5	7
Psyche (C. D. Jefferies)	9	8	3	2	5
Bob Ingersoll (W. Cecil)	6	7	2	6	3
Lynall (W. Hogoboom)	5	5	4	4	4
Alta Vela (J. N. Nelson)	3	3	6	dr.	
Bonsaline (M. Sanders)	8	9	7	7	6
Hobo (W. Masten)	1	6	9	dis.	

Time—2:15, 2:16¾, 2:18¼, 2:17¼, 2:17½.

Race No. 18—Running.

Dewey Selling Stake. Seven furlongs. For three-year-olds and upward. Entrance $10, to accompany nomination; $20 additional for horses not declared by 4 p. m. day preceding the race; $400 added by the Society, of which $70 to second and $30 to third. Winner to be sold at auction. If for $2,000, to carry rule weight; if for less, 1 lb. allowed on each $100 to $1,000; thence 2 lbs. for each $100 to $400. A winner of a stake race or three or more races of any value after closing of stake, to carry 5 lbs. extra. Maidens allowed 7 lbs. Closed with thirty-two entries. Value of stake, $840.

1. Gill Summers's b. m. Torsina (a), by Torso—Bertie W; 106 lbs.
2. W. B. Sink, Jr.'s ch. c. Formero (4), by Imp. Conveth—Formosa; 108 lbs.
3. E. E. Edwards's ch. g. Merry Boy (6), by Imp. Merriwa—Lizzie Hooker; 100 lbs.
4. The Abbey Stable's ch. m. Mocorito (5), by Amigo—Santa Monica; 97 lbs.

5. The Abbey Stable's b. m. Jennie Reid (4), by El Rio Rey—Fonsetta; 97 lbs.
6. W. L. Stanfield's ch. g. Toribio (5), by Apache—Marin; 106 lbs.
7. Budd Doble & Co.'s b. g. El Mido (4), by Sir Modred—Ethel; 102 lbs.

SUMMARY.

Torsina (Mounce)	1
Formero (Ruiz)	2
Jennie Reid (Butler)	3

Time—1:26¼.

Race No. 19—Running.

For maiden two-year-olds. Five furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $600; if for less, 3 lbs. on each $100 down to $100. Those beaten three or more times, allowed 7 lbs. Entrance fee of $10 to go to the winner.

1. D. S. Fountain's b. g. George Dewey (2), by General Miles—Georgia; 106 lbs.
2. L. Blasingame's b. f. Gertie B (2), by Lordlike—Nellie Post; 100 lbs.
3. Elmwood Farm's ch. f. Lucera (2), by Tiger—Lucia di Lammermoor; 100 lbs.
4. A. B. Spreckels's b. f. Tiolita (2), by Imp. Creighton—Tioga II; 93 lbs.
5. Matt Storn's b. f. Picklow (2), by Imp. Piccolo—Snowflake; 103 lbs.
6. N. Gibson's b. f. Narra G (2), by Bloomsbury—Zarina; 106 lbs.
7. W. M. Murry's b. g. Loyal S (2), by Imp. Loyalist—Tillie S; 102 lbs.
8. Alameda Stable's b. f. Location (2), by Imp. Prospector—Venezia; 93 lbs.
9. W. B. Jennings & Co.'s b. c. Montana Chieftain (2), by Montana—Homeless; 103 lbs.
10. C. P. Fink's b. g. Piqued (2), by Imp. Idalium—Pique; 196 lbs.

SUMMARY.

Narra G (McDonald)	1
Tiolita (Stuart)	2
George Dewey (Mounce)	3

Time—1:03.

Race No. 20—Running.

For three-year-olds and over. Six furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $800; if for less, 3 lbs. allowed for each $100 down to $300. A winner of three or more races in 1900 to carry 5 lbs. extra. Non-winners of a race allowed 5 lbs. Beaten maidens, 10 lbs. additional. Entrance fee of $10 to go to the winner.

1. H. Boone's br. f. Roulette Wheel (5), by St. George—Imp. Lonely; 109 lbs.
2. W. B. Jennings & Co.'s ch. h. Dunblane (3), by Imp. Midlothian—Loleta; 96 lbs.
3. W. H. McNames's ch. h. Sugden (4), by St. Leonards—Imp. Lucille; 115 lbs.
4. Ward Adams's b. m. Loconomo (5), by St. Savior—Lillie W; 112 lbs.
5. J. J. Moran's b. g. Grand Sachem (5), by Tammany—Belinda; 112 lbs.
6. M. A. Forster's b. g. Cowboy (a), by Dan Murphy—Indita; 107 lbs.
7. J. D. Dunn's b. g. Jack McCabe (4), by Capt. Al—Myrtle B; 102 lbs.
8. G. K. Rider's b. f. Bona (3), by Imp. True Briton—Duesa; 78 lbs.
9. J. Crane's b. g. Amasa (5), by Capt. Al—Lady Intruder; 107 lbs.
10. The Abbey Stable's ch. m. Mocorito (5), by Amigo—Santa Monica; 102 lbs.

SUMMARY.

Mocorito (McDonald)	1
Amasa (Frawley)	2
Loconomo (J. Narvaez)	3

Time—1:13¾.

Race No. 20a—Polo Pony Race.

One half mile. Purse $170, of which $100 to first, $50 to second, and $20 to third. $5 entrance to go to the winner. Minimum weight, 110 lbs.

1. M. E. Flowers's (Riverside) ch. m. Viola (a); 110 lbs.
2. M. A. Forster's (Los Angeles) ch. m. Julia (a); 110 lbs.
3. W. S. Hobart's (Burlingame) ch. m. Slats (a); 110 lbs.
4. F. J. Carolan's (Burlingame) ch. m. Princess Flavia (a); 110 lbs.
5. C. Dunphy's (Burlingame) b. m. Lady Betty (a); 110 lbs.
6. F. J. Carolan's (Burlingame) ch. h. Fusilade (a); 110 lbs.

SUMMARY.

Viola	1
Slats	2
Fusilade	3

FRIDAY, SEPTEMBER 7, 1900.

Race No. 21—Drummers' Race.

1. W. F. Peterson's ch. g. Gum Drop (Juan Chico).
2. D. McCarthy's b. g. Kiss-Me Gum.
3. H. A. Bell's br. m. Pansy.
4. Fred Martin's b. m. Wilson's High-Grade Vanilla.
5. L. S. Upson's br. g. Abdine.

SUMMARY.

Juan Chico	1	2	1
Abdine	3	1	2
Pansy	2	3	3
High-Grade Vanilla	5	4	dr.
Kiss-Me Gum	4	5	dr.

Time—2:30, 2:24, 2:23.

Race No. 22—Trotting.

Green class. Purse, $600. Mile heats, three in five.

1. W. H. Grissim's (Vallejo) b. h. Joe Selby, by Don L—The Kingsley mare.
2. D. Hinds's (Alameda) b. m. Algonita, by Eros—Algonette.
3. W. G. Durfee's (Los Angeles) blk. m. Maggie McKinney, by McKinney—Maggie E.
4. Ben Liebes's (San Francisco) b. h. Ben Liebes, by McKinney—Belle McGregor.
5. P. Henshaw's (Chico) b. g. Monte Carlo, by Mendocino—Dam by Tilton Almont.
6. W. Morgan's (Los Angeles) b. m. Una K, by McKinney.
7. C. P. Chamberlain's (Rossland, B.C.) g. g. Greyling, by Hambletonian Mambrino—Lady Grey.
8. J. M. Lipson's (San Bernardino) b. g. Potomac, by Albion—Grace D.
9. Rose Dale Stock Farm's (Santa Rosa) b. m. Bertha R, by Daly.

SUMMARY.

Monte Carlo (J. Sullivan)	1	1	1
Maggie McKinney (W. G. Durfee)	2	5	2
Bertha R (W. Hogoboom)	6	2	4
Ben Liebes (C. A. Durfee)	3	3	5
Algonita (J. M. Nelson)	4	4	3
Joe Selby (J. S. Smith)	5	6	6
Potomac (J. Donahue)	dis.		

Time—2:20, 2:21, 2:19½.

Race No. 22a—Polo Pony Race.

Five eighths of a mile. Purse, $170.

1. W. S. Hobart's ch. m. Slats (a); 110 lbs.
2. F. J. Carolan's ch. c. Fusilade (a); 110 lbs.
3. C. Dunphy's b. m. Lady Betty (a); 110 lbs.
4. M. E. Flowers's ch. m. Viola (a); 110 lbs.
5. M. A. Forster's b. m. Julia (a); 110 lbs.

SUMMARY.

Viola	1
Fusilade	2
Slats	3

Time—1:02¼.

Race No. 23—Running.

For three-year-olds and over. Seven furlongs. Purse, $300, of which $50 to second and $25 to third. For horses entered in any stake this meeting that have not won more than three races this year. Three-year-olds to carry 107 lbs.; four-year-olds and over to carry 114 lbs. Entrance fee of $10 to go to the winner.

1. Elmwood Farm's b. c. Constellator (3), by Imp. Brutus—Constellation; 107 lbs.
2. J. Gibson's b. m. Snips (5), by Fellowcharm—Czarina; 111 lbs.
3. J. J. Moran's ch. c. Bathos (3), by Imp. Bathampton—Crisis; 107 lbs.

4. G. Brown's b. m. Mabel L (a), by Major Ban—Acquito; 111 lbs.
5. W. B. Sink, Jr.'s ch. g. Rio Chico (4), by Imp. Chesterfield—Jennie D; 114 lbs.
6. W. M. Murry's br. g. Casdale (4), by Faverdale—Castalia; 114 lbs.
7. The Abbey Stable's b. m. Jennie Reid (4), by El Rio Rey—Fonsetta; 111 lbs.

SUMMARY.

Constellator (Butler)	1
Snips (McDonald)	2
Casdale (Frawley)	3

Time—1:27½.

RACE NO. 24—RUNNING.

For three-year-olds and over. One and one sixteenth miles. Selling. Purse, $250, of which $50 to second and $25 to third. For horses that have not won more than three races in 1900. Winner to be sold for $1,000; if for less, 2 lbs. allowed on each $100 down to $100. Entrance fee of $10 to go to the winner.

1. Dan Morgan's b. g. McFarlane (a), by Mariner—Moonlight; 106 lbs.
2. Matt Storn's b. g. Sunello (3), by Morello—Sunlit; 104 lbs.
3. Elmwood Farm's br. g. Edgardo (3), by Tiger—Lucia di Lammermoor; 96 lbs.
4. C. Spooner's ch. g. Don Luis (5), by Imp. Midlothian—Alameda; 104 lbs.
5. A. J. Stemler & Co.'s ch. g. Lodestar (a), by Imp. Midlothian—Starlight; 108 lbs.
6. J. Sullivan's b. m. Glen Ann (5), by Sir Modred—Glencola; 101 lbs.
7. W. M. Murry's ch. g. Cromwell (a), by St. Blaise—Flavina; 110 lbs.
8. F. T. Nichols's ch. m. Lena (6), by Apache—Rill; 105 lbs.
9. M. A. Forster's b. g. Rey del San Juan (4), by Dan M. Murphy—Zingerella; 110 lbs.
10. Owen Bros.' b. c. Grady (a), by Three Cheers—Gold Cup; 104 lbs.

SUMMARY.

Cromwell (Ruiz)	1
Sunello (Powell)	2
Lodestar (Farrell)	3

Time—1:48¼.

RACE NO. 25—RUNNING.

For two-year-olds. Five and one half furlongs. Selling. Purse, $250, of which $50 to second and $25 to third. Winner to be sold for $800; if for less, 2 lbs. allowed for each $100 down to $200. A winner of three or more races not allowed to be entered for less than $600. Maidens allowed 5 lbs. Maidens beaten three or more times, 10 lbs. Entrance fee of $10 to go to the winner.

1. Thomas Fox's br. c. Phil Archibald (2), by Imp. Artillery—Flossy; 106 lbs.
2. Elmwood Farm's ch. c. Illilouon (2), by Tiger—Gipsette; 110 lbs.
3. L. McArthur's b. c. Game Warden (2), by Take Notice—The Teal; 106 lbs.
4. W. H. McNames's ch. g. Little Jim (2), by Chesterfield—Savannah; 106 lbs.
5. Alameda Stable's b. g. St. Rico (2), by St. Andrew—Ricardo; 112 lbs.
6. P. Donalache's b. c. Wardman (2), by Tammany—Belinda; 96 lbs.

SUMMARY.

St. Rico (Ruiz)	1
Illilouon (Hennessy)	2
Phil Archibald (Frawley)	3

Time—1:08.

SATURDAY, SEPTEMBER 8, 1900.

RACE NO. 26—PACING.

2:15 class. Purse, $1,000. Mile heats, three in five.

1. W. W. Whitney's (Santa Ana) ch. g. Bernard, by Jim Blaine—Nellie Clay.
2. B. F. White's (Dillon, Mont.) b. m. Ratatat, by Copper King—Latatat.
3. A. W. Breuner's (Sacramento) ch. h. Stanton Wilkes, by Nutwood Wilkes—Eva.
4. G. Periano's (Lodi) ch. h. Alta Genoa, by Dexter Prince—Brownie.
5. Mrs. C. B. Bigelow's (Woodland) b. m. Tags, by Diablo—Bonnie B.
6. G. Y. Bollinger's (San José) —— ——
7. Ed. Kavanaugh's (Vallejo) ch. h. Gaff Topsail, by Diablo—Belle.
8. P. W. Hodges's (Los Angeles) b. m. Queen R, by Redondo—Dam by Adrian Wilkes.
9. S. C. Tryon & Co.'s (Sacramento) br. m. Margaretta, by Direct—Rosita A.
10. M. Hart's (San Francisco) br. m. Hermia, by Soudan—Hattie.

SUMMARY.

Queen R (P. W. Hodges)	1	1	1
Hermia (R. Havey)	3	2	2
Gaff Topsail (J. L. Smith)	6	3	3
Tags (C. B. Bigelow)	4	4	4
Stanton Wilkes (J. T. Donnelly)	2	5	dis.
Alta Genoa (G. Periano)	5	dis.	
Ratatat (M. H. Williams)	dis.		

Time—2:12¼, 2:15, 2:16.

Race No. 27—Trotting.

2:19 class. Purse, $1,000. Mile heats, three in five.

1. Dan Finn's (Hanford) b. h. Col. K. R., by Bay Rose—Addie E.
2. S. C. Tryon & Co.'s (Sacramento) r. h. Richmond Chief, by Monroe Chief—Dam by A. W. Richmond.
3. S. A. Hooper's (Yountville) b. m. Dora Doe, by Don Lowell—Molly.
4. L. M. Clark's (Carson) b. h. Ouiboul, by Stamboul—Ouida.
5. J. O. Parrott's (San Francisco) b. g. Dolador, by Advertiser—Dam by Nutwood.
6. Alex Brown's (Walnut Grove) b. h. Prince Ansel, by Dexter Prince—Woodflower.
7. G. Y. Bollinger's (San José) b. m. Belle Patchen, by Alto Rex—Last Chance.
8. S. H. Hoy's (Winters) br. g. McNally, by McKinney—Dam by Alcazar.
9. W. G. Durfee's (Los Angeles) blk. g. Charlie Mc, by McKinney—Dam by Doncaster.

SUMMARY.

McNally (S. H. Hoy)	6	1	1	1
Dora Doe (S. A. Hooper)	1	2	4	3
Charlie Mc (W. G. Durfee)	4	6	2	2
Richmond Chief (W. Tryon)	3	3	3	5
Belle Patchen (F. Ward)	5	4	6	4
Ouiboul (L. M. Clark)	7	5	5	6
Prince Ansel (H. Spencer)	2	7	dis.	

Time—2:15, 2:15, 2:15¼, 2:17.

Race No. 28—Running.

The Vinctor Stake, for three-year-olds and upward. One mile. Entrance $10, to accompany nomination; $20 additional for horses not declared by 4 P. M. day preceding the race; $400 added by the Society, of which $70 to second and $30 to third. Stake to be named after winner if Vinctor's time (1:40) is beaten. A non-winner of a stake race in 1900, or a race of the value of $500, allowed, if a non-winner of five races other than selling races, 5 lbs. Maidens 7 lbs. additional. Closed with twenty-four entries. Value of stake, $740.

1. Elmwood Farm's b. c. Constellator (3), by Imp. Brutus—Constellation; 107 lbs.
2. Gill Summers's ch. g. Herculean (3), by Imp. Watercress—Hana; 107 lbs.
3. The Abbey Stable's b. m. Jennie Reid (4), by El Rio Rey—Fonsetta; 114 lbs.
4. W. B. Sink, Jr.'s ch. c. Formero (4), by Imp. Conveth—Formosa; 117 lbs.
5. W. L. Stanfield's ch. g. Toribio (5), by Apache—Marin; 117 lbs.

SUMMARY.

Formero (Ruiz)	1
Herculean (Mounce)	2
Toribio (Stuart)	3

Time, 1:41.

Race No. 29—Running.

For two-year-olds that have not won two races. Five furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $700; if for less, 3 lbs. allowed for each $100 down to $200. Maidens allowed 5 lbs. If beaten three or more times and not placed second or third, 10 lbs. Entrance fee of $10 to go to the winner.

1. Budd Doble & Co.'s ch. c. El Topio (2), by Emperor Norfolk—Arrapahoe; 101 lbs.
2. D. S. Fountain's b. f. Undergrowth (2), by Lordlike—Ogalena; 96 lbs.
3. A. B. Spreckels's b. f. Tiolita (2), by Imp. Creighton—Tioga II; 95 lbs.
4. Thomas Fox's br. f. Screenwell Lake (2), by Imp. Artillery—Lake County; 103 lbs.
5. Alameda Stable's b. f. Location (2), by Imp. Prospector—Venezia; 90 lbs.
6. W. B. Jennings & Co.'s b. c. Canmore (2), by Imp. Midlothian—Fannie Louise; 98 lbs.

SUMMARY.

Canmore (Butler)	1
Location (Logue)	2
El Topio (Collis)	3

Time—1:02¼.

RACE NO. 29A—RUNNING.

For three-year-olds and over. Six furlongs. Selling. Purse $300, of which $50 to second and $25 to third. Winner to be sold for $1,000; 2 lbs. allowed on each $100 down to $300. Non-winners of five races in 1900 allowed 5 lbs. Winner of a stake at this meeting not eligible. Entrance fee of $10 to go to the winner.

1. F. H. Smythe's b. m. Little Sister (6), by Friar Tuck—St. Saviour Mare; 100 lbs.
2. J. D. Dunn's b. g. Pompino (4), by Puryear D—Sweet Peggy; 107 lbs.
3. M. T. Walters's ch. m. Della Connor (4), by Connor—Della Walker; 100 lbs.
4. W. R. Larzelere's br. f. Jingle Jingle (4), by Imp. Brutus—Nabette; 100 lbs.
5. The Abbey Stable's ch. m. Mocorito (5), by Amigo—Santa Monica; 104 lbs.
6. E. E. Edwards's ch. g. Merry Boy (6), by Imp. Merriwa—Lizzie Hooker; 105 lbs.
7. M. A. Forster's b. g. Cowboy (3), by Dan Murphy—Indita; 97 lbs.
8. A. B. Spreckels's b. g. Bamboulia (3), by Puryear D—Lista Hock; 101 lbs.
9. W. H. McNames's ch. g. Sugden (4), by St. Leonards—Imp. Lucille; 103 lbs.

SUMMARY.

Pompino (H. Stuart)	1
Merry Boy (Farrell)	2
Mocorito (McDonald)	3

Time—1:14.

RACE NO. 29B—RUNNING.

For three-year-olds and upward. Six furlongs. Selling. Purse $200, of which $50 to second and $25 to third.

1. Martin Duffy's b. g. Phlegon (3), by Imp. Piccolo—Little Rose; 94 lbs.
2. L. McArthur's b. g. Pilot (3), by Morello—Adelante; 96 lbs.
3. W. M. Murry's b. g. Only Me (5), by Prince Royal—Imp. Manzanita; 107 lbs.
4. E. Lloyd & Co.'s ch. g. Cæsar Young (3), by Hanover—Mollie Seabrook; 89 lbs.
5. Alameda Stable's b. f. Lobosina (3), by Golden Garter—Tremblor; 94 lbs.
6. Elmwood Farm's br. g. Letiger (3), by Tiger—Letitia; 93 lbs.
7. J. D. Dunn's b. g. Jack McCabe (4), by Capt. Al—Myrtle B; 102 lbs.
8. J. Crane's b. g. Amasa (5), by Capt. Al—Lady Intruder; 110 lbs.
9. J. Weber's b. g. Abano (4), by Imp. Creighton—Glee; 110 lbs.

SUMMARY.

Amasa (Frawley)	1
Pilot (Mounce)	2
Phlegon (Fogg)	3

Time—1:15.

MONDAY, SEPTEMBER 10, 1900.

RACE NO. 30—TROTTING.

The Stanford Stake for 1900; for foals of 1897. Mile heats, three in five. $50 entrance, of which $5 accompanied nomination May 2, 1898; $5 paid January 1, 1899; $10 January 1, 1900; $10 July 1, 1900, and $20 on the tenth day before the first day of the State Fair of 1900. $300 added by the Society. Closed with thirty entries, of which five made the final payment. Total stakes paid in, $565.

1. E. P. Heald's (San Francisco) br. c. Tom Smith, by McKinney—Daisy S.
2. Vendome Stock Farm's (San José) b. c. Vendome, by Iran Alto—Lynda Oak.
3. H. L. Frank's (San Francisco) b. c. Ben Liebes, by McKinney—Belle McGregor.
4. J. B. Iverson's (Salinas) br. f. Dagmar, by McKinney—Steinway Maid.
5. La Siesta Ranch's (San José) b. g. The Roman, by McKinney—Wanda.

SUMMARY.

The Roman (E. Lafferty)	1	1	1
Ben Liebes (C. A. Durfee)	2	2	3
Tom Smith (J. Smith)	4	3	2
Vendome (C. F. Bunch)	3	4	4
Dagmar (C. Rodriguez)	dis.		

Time—2:18¾, 2:20, 2:19.

RACE NO. 31—TROTTING.

2:12 class. Purse, $1,000. Mile heats, three in five.

1. Santa Rosa Stock Farm's (Santa Rosa) b. m. Dolly Dillon, by Sidney Dillon—Dolly, by Electioneer.
2. Tuttle Bros.' (Rocklin) b. h. Stam B, by Stamboul—Belle Medium.
3. A. W. Breuner's (Sacramento) br. g. El Moro, by Longworth—Dam by Anteeo.
4. T. J. Crowley's (San Francisco) blk. g. Addison, by James Madison—Dam by Berlin.
5. Mrs. S. V. Barstow's (San José) b. g. Claudius, by Nutwood Wilkes—Fanny Menlo.
6. J. B. Iverson's (Salinas) br. g. Prince Gift, by Good Gift—Belle.
7. C. A. Durfee's (Oakland) b. m. Miss Jessie, by Gossiper—Leonore.
8. P. W. Hodges's (Los Angeles) b. m. Hazel Kinney, by McKinney—Baby Gift.
9. Vendome Stock Farm's (San José) b. h. Iran Alto, by Palo Alto—Elaine.

SUMMARY.

Hazel Kinney	3	1	2	1	1
Dolly Dillon	5	2	1	2	4
Miss Jessie	1	3	4	3	3
Claudius	2	4	3	4	2
Iran Alto	4	dis.			

Time—2:13¾, 2:13, 2:14¾, 2:15½, 2:16.

RACE NO. 32—RUNNING.

For three-year-olds and over. Six furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $700; if for less, 3 lbs. allowed for each $100 down to $200. A winner of three or more races this year not to be entered for less than $400. Horses beaten at this meeting allowed 5 lbs. Maidens allowed 10 lbs.

1. P. Herzog's b. c. Tres Jolie (3), by Imp. True Briton—Marguerita; 100 lbs.
2. J. J. O'Malley's ch. m. Torsida (5), by Torso—Judith; 107 lbs.
3. M. A. Forster's b. g. Cowboy (3), by Dan Murphy—Indita; 104 lbs.
4. Martin Duffy's b. g. Phlegon (3), by Imp. Piccolo—Little Rose; 99 lbs.
5. A. J. Stemler & Co.'s b. h. Lou Rey (4), by El Rio Rey—Louise M; 110 lbs.
6. Jay Wheeler's ch. g. St. Apollinaris (4), by St. Carlo—Glenlivet; 110 lbs.
7. Elmwood Farm's b. g. Meadow Lark (a), by Imp. Brutus—Nabette; 110 lbs.
8. Budd Doble & Co.'s blk. f. Louise Hayman (3), by Hawksley—Sunbeam; 100 lbs.
9. J. Crane's b. m. Dolore (a), by Wild Idle—Rosette; 107 lbs.
10. A. B. Spreckels's b. g. Bamboulia (3), by Puryear D—Lista Hock; 104 lbs.

SUMMARY.

Torsida (Farrell)	1
Cowboy (Powell)	2
Lou Rey (Halfey)	3

Time—1:14¾.

RACE NO. 33—RUNNING.

For three-year-olds and upward that have not won more than three races in 1900. One mile. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $1,000; if for less, 2 lbs. allowed on each $100 down to $100.

1. W. M. Murry's b. g. Casdale (4), by Faverdale—Castalia; 102 lbs.
2. C. R. Thompson's b. g. Sea Spray (a), by Mariner—Marin; 113 lbs.
3. Ward Adams's b. m. Loconomo (5), by St. Saviour—Lillie W; 108 lbs.
4. Pete Smith's ch. g. Expedient (3), by Flambeau—Experiment; 93 lbs.
5. Budd Doble & Co.'s b. g. El Mido (4), by Sir Modred—Ethel; 108 lbs.
6. J. J. Moran's b. g. Grand Sachem (5), by Tammany—Belinda; 108 lbs.
7. J. Gibson's b. m. Snips (4), by Fellowcharm—Czarina; 105 lbs.
8. J. Martin, Jr.'s b. c. Hipponax (3), by Piccolo—Lowland Lass; 96 lbs.
9. J. Touhey & Co.'s b. h. Briar Hill (5), by Duncombe—Brierbush; 105 lbs.

SUMMARY.

El Mido (Mounce)	1
Snips (McDonald)	2
Grand Sachem (Hennessy)	3

Time—1:41.

RACE NO. 34—RUNNING.

For three-year-olds and upward that have started at this meeting and not won two races in 1900. Six furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $1,000; if for less, 3 lbs. allowed for each $100 down to $300. Beaten non-winners in 1900 and beaten maidens allowed 10 lbs.

1. Elmwood Farm's br. g. Letiger (3), by Tiger—Letitia; 85 lbs.
2. Owen Bros.' b. f. Flush of Gold (3), by Royal Flush—Gold Cup; 92 lbs.
3. P. H. Hickey's b. g. Abano (4), by Imp. Creighton—Glee; 104 lbs.
4. J. S. Gibson's b. f. February (a), by St. Carlo—Sister to Ruth Ryan; 103 lbs.
5. J. J. Moran's ch. c. Bathos (3), by Imp. Bathampton—Crisis; 100 lbs.
6. Matt Storn's b. g. Sunello (3), by Morello—Sunlit; 104 lbs.
7. W. B. Jennings & Co.'s ch. c. Asian (3), by Imp. Goldfinch—Lydia; 105 lbs.

SUMMARY.

Asian (Mounce)	1
February (McDonald)	2
Flush of Gold (Stuart)	3

Time—1:14.

TUESDAY, SEPTEMBER 11, 1900.

RACE NO. 35—PACING.

2:18 class. Purse, $1,000. Mile heats, three in five.

1. J. S. Hodges's (Los Angeles) b. g. Dictatus, by Red Wilkes—Miss Lottie.
2. A. B. Spreckels's (San Francisco) g. g. Mulcahy, by Aptos Wilkes—Dam by St. Clair.
3. H. H. Dunlap's (San Francisco) b. g. King Cadenza, by Steinway—Empress.
4. B. F. White's (Dillon, Mont.) b. m. Ratatat, by Copper King—Latatat.
5. Chanslor & Canfield's (Fresno) br. m. Chloe, by Conifer—Bonnie McGregor.
6. A. W. Breuner's (Sacramento) ch. h. Stanton Wilkes, by Nutwood Wilkes—Eva.
7. S. Layng's (San Francisco) b. g. Sir Albert S, by Diablo—Effie Logan.
8. Mrs. C. B. Bigelow's (Woodland) b. m. Tags, by Diablo—Bonnie B.
9. Lot D. Slocum's (San Francisco) r. g. Teddy the Roan, by Sidmoor—Vesper Bells.
10. G. Y. Bollinger's (San José) ch. m. Our Boy's Sister, by Baywood—Nellie Bly.
11. J. J. Sangster's (Marysville) br. m. Jennie S, by Directum—Dam by Nephew.
12. I. L. Borden's (San Francisco) ch. g. N. L. B., by Diablo—Alice Bell.
13. Vendome Stock Farm's (San José) ch. g. Fredericksburg, by Nephew, Jr.—Minnie Hubbard.
14. Suel Harris's (Yuba City) b. m. Sutter Maid, by Constantine—Dam by Washington.
15. E. Kavanaugh's (Vallejo) ch. h. Gaff Topsail, by Diablo—Belle.
16. E. Nanny's (Marysville) b. h. Glenway, by Strathway—Birdie.
17. E. Graser's ———.
18. W. P. Meredith's (Tombstone) br. h. Wopolo, by Tom Hal, Jr.—Dolly M.
19. Nutwood Stock Farm's (Irvington) ch. g. Irvington Boy, by Nutwood Wilkes—Lady Lyons.

SUMMARY.

King Cadenza (H. Dunlap)	2	9	1	4	1	1
Fredericksburg (C. T. Bunch)	1	8	2	1	6	3
Tags (C. B. Bigelow)	3	1	3	2	2	2
Irvington Boy (W. Cecil)	6	2	4	5	4	r. o.
Chloe (C. E. Clark)	5	5	7	3	3	r. o.
Glenway (J. Albertson)	9	3	5	6	5	r. o.
Jennie S (J. Sangster)	7	6	8	7	7	r. o.
Gaff Topsail (J. L. Smith)	4	7	6	8	dis.	
Dictatus (C. Day)	8	4	dis.			

Time—2:13¼, 2:18, 2:15½, 2:17¼, 2:17, 2:19.

RACE NO. 36—TROTTING.

2:16 class. Purse, $600. Mile heats, three in five.

1. D. Hinds's (Alameda) b. h. Alta Vela, by Electioneer—Loretta.
2. Alex Brown's (Walnut Grove) br. m. Lottie, by San Diego—Dam by Whippleton.
3. Santa Rosa Stock Farm's (Santa Rosa) b. m. Bonsaline, by Stamboul—Bon Bon.
4. Albertson & McNeil's (Marysville) r. g. Dan W, by Hero—Dam by Mambrino Prince.
5. A. B. Spreckels's (San Francisco) ch. m. Psyche, by Cupid—Emma S.
6. George Kingsbury's (San Francisco) s. g. Lynall, by Lynmont—Balance All.

SUMMARY.

Bonsaline (M. Sanders)	3	1	1	1
Lottie (C. Spencer)	1	2	3	5
Alta Vela (J. Nelson)	6	3	2	2
Dan W (J. Albertson)	2	6	4	3
Lynall (C. Jeffries)	4	4	6	4
Psyche (W. Hogoboom)	5	5	5	6

Time—2:17¾, 2:17½, 2:15¼, 2:16½.

Race No. 37—Running.

The Futurity Stake; a sweepstake for two-year-olds, foals of 1898. Six furlongs. Colts to carry 118 lbs., fillies 115 lbs. The winner of a stake of the value of $1,500 or two of $1,000 each, to carry 3 lbs. extra. The winner of a stake of the value of $2,500, or two of the value of $1,500 each, to carry 5 lbs. extra. Allowances: Beaten maidens allowed 3 lbs. for once, 5 lbs. for twice; if beaten three or more times and not placed 1, 2, 3, allowed 10 lbs. The produce of the mares not having foaled a winner prior to January 1, 1898, to be allowed 5 lbs. additional, if claimed at time of entry of mare. Closed with 45 entries, of which 14 were refunded; 31 made first payment of $10, $310; 24 made second payment of $10, $240; 18 made third payment of $15, $270; 16 made fourth payment of $25, $400. Total paid in to August 20th, $1,220. And a further payment of $50 each due September 1, 1900. Total value, $2,480.

1. Alameda Stable's b. g. St. Rica (2), by St. Andrew—Ricardo; 118 lbs.
2. Burns & Waterhouse's br. c. Dunfree (2), by Imp. Duncombe—Free Love; 118 lbs.
3. A. J. Stemler & Co.'s b. f. Lily Andrew (2), by Imp. St. Andrew—Hot Springs; 115 lbs.
4. Burns & Waterhouse's b. f. Spainwar (2), by Imp. Artillery—Sweet Rose; 105 lbs.
5. J. P. Diggs's b. f. Lily Diggs (2), by Red Iron—Lily Wright; 115 lbs.

SUMMARY.

St. Rica (Ruiz)	1
Lily Andrew (Farrell)	2
Spainwar (Butler)	3

Time—1:16.

Race No. 38—Running.

For three-year-olds and upward. One mile. Selling. Purse $300, of which $50 to second and $25 to third. Winner to be sold for $1,000; 2 lbs. allowed for each $100 down to $300. Non-winners of five races in 1900 allowed 5 lbs.

1. J. D. Dunn's b. g. Pompino (4), by Puryear D—Sweet Peggy; 107 lbs.
2. E. E. Edwards's ch. g. Merry Boy (6), by Imp. Merriwa—Lizzie Hooker; 105 lbs.
3. The Abbey Stable's b. f. Jennie Reid (4), by El Rio Rey—Fonsetta; 104 lbs.
4. W. H. McNames's ch. h. Sugden (4), by St. Leonards—Imp. Lucille; 103 lbs.
5. W. R. Larzelere's br. f. Jingle Jingle (4), by Imp Brutus—Nabette; 100 lbs.
6. J. Moran's ch. c. Bathos (3), by Imp. Bathampton—Crisis; 93 lbs.
7. Matt Storn's b. f. Morinel (4), by Morello—Sunlit; 104 lbs.
8. W. M. Murry's br. g. Kickumbob (3), by Imp. Idalium—Maria F; 93 lbs.
9. W. L. Stanfield's b. g. Castake (5), by Apache—Lina; 108 lbs.

SUMMARY.

Morinel (Powell)	1
Jennie Reid (McNichols)	2
Merry Boy (Farrell)	3

Time—1:42¼.

Race No. 39—Running.

For three-year-olds and upward that have not won more than two races in 1899 and 1900. Six furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold at auction for $300; 10 lbs. below scale. Beaten maidens allowed 7 lbs.; other horses beaten at this meeting allowed 5 lbs.

1. J. Martin, Jr.'s b. m. Petal (5), by Oscar—Little Rose; 104 lbs.
2. Jay Wheeler's ch. g. St. Apollinaris (4), by St. Carlo—Glenlivet; 107 lbs.
3. M. T. Walters's ch. m. Della Connor (4), by Connor—Della Walker; 102 lbs.
4. W. R. Larzelere's b. g. St. Anthony (3), by St. Andrew—Half Sister; 101 lbs.

5. W. B. Jennings & Co.'s ch. c. Redwald (3), by Tenny—Imp. Redworth Rose; 101 lbs.
6. A. B. Spreckels's b. m. Nihau (5), by St. Saviour—Yarranabee; 102 lbs.
7. Miss M. O'Connell's b. g. Tenrica (5), by Tenny—Princess Fredrica; 112 lbs.
8. Halford & Corey's b. h. Harry Gwynn (6), by Pontico—Nellie Gwynn; 112 lbs.
9. J. H. Mulholland's ch. g. Limber Jim (a), by Snuffbox—Mildew; 112 lbs.
10. G. K. Rider's ch. f. Bona (3), by Imp. True Briton—Duesa; 96 lbs.
11. Stony & Davis's ch. g. Alturas (4), by Shannon—Avondale; 107 lbs.

SUMMARY.

Alturas (Collis)	1
Redwald (Ames)	2
Limber Jim (Stuart)	3

Time—1:14¼.

RACE NO. 39A—POLO PONY RACE.

One half mile. Purse, $170.

1. F. J. Carolan's ch. h. Fusilade (a); 155 lbs.
2. W. S. Hobart's ch. m. Slats (a); 155 lbs.
3. M. E. Flowers's ch. m. Viola (a); 155 lbs.
4. M. A. Forster's ch. m. Julia (a); 155 lbs.

SUMMARY.

Viola	1
Fusilade	2
Slats	3

Time—0:49.

WEDNESDAY, SEPTEMBER 12, 1900.

RACE NO. 40—TROTTING.

2:21 class. Purse, $1,000. Mile heats, three in five.

1. James Coffin's (San Francisco) br. g. Puerto Rico, by Sadie Wilkes—Mamie Kohl.
2. J. D. Carr's (Salinas) b. h. Silvian, by Electricity—Lucky Girl.
3. S. C. Tryon & Co.'s (Sacramento) r. h. Richmond Chief, by Monroe Chief—Dam by A. W. Richmond.
4. S. A. Hooper's (Yountville) b. m. Dora Doe, by Don Lowell—Molly.
5. L. M. Clark's (Carson) b. h. Ouiboul, by Stamboul—Ouida.
6. A. W. Breuner's (Sacramento) ——— ———.
7. C. W. Hamerton's (Oakland) b. g. General Smith, by Don Lowell—Dam by Brigadier.
8. Rose Dale Stock Farm's (Santa Rosa) b. m. Julia S, by Daly.
9. Alex Brown's (Walnut Grove) b. h. Prince Ansel, by Dexter Prince—Woodflower.
10. G. Y. Bollinger's (San José) ——— ———.
11. H. W. Meek's (San Lorenzo) b. m. Janice, by Wm. Harold—Fenella.
12. Joseph Edge's (Vallejo) b. g. Hank, by Vasto—Dam by Wyoming Chief.
13. P. W. Hodges's (Los Angeles) b. m. Atherine, by Patron—Dam by Harold.
14. P. Henshaw's (Chico) b. g. Monte Carlo, by Mendocino—Dam by Tilton Almont.
15. W. G. Durfee's (Los Angeles) b. m. Miss Barnabee, by McKinney—Del Amo.

SUMMARY.

Janice (B. Simpson)	4	3	3	1	2	1	1
Richmond Chief (E. Lafferty)	1	2	2	4	1	3	3
Dora Doe (S. A. Hooper)	2	1	5	3	3	2	2
General Smith (J. W. Donathan)	6	5	4	5	5	r. o.	
Atherine (P. W. Hodges)	7	6	6	6	dr.		
Miss Barnabee (W. G. Durfee)	3	7	7	dr.			
Monte Carlo (J. Sullivan)	5	4	1	2	4	4	dis.

Time—2:16, 2:14½, 2:14¼, 2:16, 2:16, 2:17¾, 2:21½.

RACE NO. 41—PACING.

Special purse, $600. Mile heats, three in five. For Clipper, Little Thorne, Kelly Briggs, and all other pacers.

Did not fill.

RACE NO. 42—TROTTING.

For two-year-olds (2:40 class). $30 entrance, of which $5 must accompany nomination; $10 payable July 1, and the remaining $15 payable August 15, 1900. $200 added by the Society. Closed May 15th with eight entries, of which two made final payment. Total paid in, $100. No added money under conditions.

1. C. A. Owen's ch. c. Le Roy, by Waldstein—Zadie McGregor.
2. A. M. McCollum's ch. f. Jennie H, by Algona—Rosa Lee.

SUMMARY.

Le Roy (Owen)	1	1
Jennie H (A. Walden)	2	2

Time—2:55, 2:50.

RACE NO. 43—RUNNING.

For maiden two-year-olds. Five and one half furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $600; if for less, 3 lbs. on each $100 down to $100. Those beaten at this meeting, and not having been placed second or third, allowed 7 lbs.

1. A. B. Spreckels's b. f. Tiolita (2), by Imp. Creighton—Tioga II; 100 lbs.
2. W. M. Murry's b. g. Loyal S (2), by Imp. Loyalist—Tillie S; 111 lbs.
3. D. S. Fountain's b. g. George Dewey (2), by General Miles—Georgia; 106 lbs.
4. Alameda Stable's b. f. Location (2), by Imp. Prospector—Venezia; 100 lbs.
5. Thomas Fox's br. h. Phil Archibald (2), by Imp. Artillery—Flossy; 106 lbs.
6. Budd Doble & Co.'s ch. c. El Topio (2), by Emp. Norfolk—Arrapahoe; 109 lbs.

SUMMARY.

Phil Archibald (Frawley)	1
George Dewey (Mounce)	2
Location (Logue)	3

Time—1:10.

RACE NO. 44—RUNNING.

Handicap. Six furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $300.

1. Owen Bros.' b. f. Flush of Gold (3), by Royal Flush—Gold Cup; 100 lbs.
2. A. J. Stemler & Co.'s ch. g. Lodestar (a), by Imp. Midlothian—Starlight; 106 lbs.
3. Ward Adams's b. m. Loconomo (5), by St. Saviour—Lillie W; 104 lbs.
4. Alameda Stable's b. f. Lobosina (3), by Golden Garter—Tremblor; 92 lbs.
5. Chas. Quick's br. g. Artilleryman (3), by Imp. Artillery—Clara L; 95 lbs.
6. J. McCarty's b. g. Almoneer (4), by Imp. Midlothian—Charity; 118 lbs.
7. A. B. Spreckels's b. g. Bamboulia (3), by Puryear D—Lista Hock; 97 lbs.

SUMMARY.

Lodestar (Farrell)	1
Flush of Gold (Powell)	2
Loconomo (Gaffney)	3

Time—1:14.

RACE NO. 45—RUNNING.

For maiden three-year-olds and upward. Seven furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $700; if for less, 4 lbs. allowed for each $100 down to $200.

1. Elmwood Farm's b. g. Formatus (3), by Imp. Brutus—Forma; 108 lbs.
2. E. Lloyd & Co.'s ch. g. Hiram Johnson (3), by Flambeau—Charm; 96 lbs.
3. C. P. Fink's b. g. Urchin (3), by Kingston—Mary M; 96 lbs.
4. Alameda Stable's b. g. Trevathan (3), by Bassetlaw—Mercedes; 108 lbs.
5. W. M. Murry's b. g. Only Me (5), by Prince Royal—Imp. Manzanita; 102 lbs.
6. Martin Duffy's b. h. Phlegon (3), by Imp. Piccolo—Little Rose; 96 lbs.
7. A. B. Spreckels's ch. m. Ulloa (4), by Imp. Creighton—Imp. Zara; 99 lbs.
8. W. Maben's b. m. Miss Vera (3), by Amigo—Fame; 93 lbs.

SUMMARY.

Phlegon (Fogg)	1
Trevathan (Ruiz)	2
Miss Vera (Brodein)	3

Time—1:29¼.

RACE NO. 45A—RUNNING.

For three-year-olds and upward. One and one sixteenth miles. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $600; if for less, 3 lbs. allowed on each $100 down to $100. Winners at this meeting to carry 5 lbs. extra.

1. J. J. Moran's b. g. Grand Sachem (5), by Tammany—Belinda; 110 lbs.
2. Miss M. O'Connell's b. g. Tenrica (5), by Tenny—Princess Fredrica; 107 lbs.
3. P. Moore's ch. m. Alicia (a), by Malcolm—Viney; 104 lbs.
4. Elmwood Farm's br. g. Edgardo (3), by Tiger—Lucia di Lammermoor; 100 lbs.
5. M. J. McCune's b. g. None Such (5), by Keyser—Edith B; 104 lbs.
6. Owen Bros.' b. h. Grady (a), by Three Cheers—Gold Cup; 107 lbs.
7. J. J. O'Malley's ch. m. Torsida (5), by Torso—Judith; 112 lbs.

SUMMARY.

Edgardo (Mounce)	1
Alicia (Butler)	2
Grand Sachem (Thomas)	3

Time—1:48½.

THURSDAY, SEPTEMBER 13, 1900.

RACE NO. 46—TROTTING.

Special race for Sacramento County roadsters. Purse $250. Mile heats, three in five.

1. L. S. Upson's (Sacramento) Munyon.
2. F. E. Wright's (Sacramento) Peo.
3. E. J. Weldon's (Sacramento) Our Boy.
4. Harry Bell's (Sacramento) Pansy.
5. J. Callendine's (Sacramento) Abdine.
6. Homer Buckman's (Sacramento) Baby Button.

SUMMARY.

Our Boy (E. J. Weldon)	2	2	1	1	1
Abdine (J. Callendine)	1	1	2	2	4
Munyon (L. S. Upson)	3	4	6	6	2
Peo (F. E. Wright)	4	3	3	5	5
Pansy (Harry Bell)	5	5	4	3	6
Baby Button (Homer Buckman)	6	6	5	4	3

Time—2:19¼, 2:20, 2:19½, 2:23½, 2:23.

RACE NO. 47—TROTTING.

Free-for-all. Purse, $1,000. Mile heats, three in five.

1. Santa Rosa Stock Farm's (Santa Rosa) b. m. Dolly Dillon, by Sidney Dillon—Dolly.
2. Tuttle Bros.' (Rocklin) b. h. Stam B, by Stamboul—Belle Medium.
3. Hogoboom & Kingsbury's (Marysville) b. g. Daimont, by Lynmont—Daisy.
4. L. E. Clawson's (San Francisco) b. m. Phœbe Childers, by Sir Roderick—Martha Washington.
5. A. B. Spreckels's (San Francisco) b. m. Dione, by Eros—Grace S.

SUMMARY.

Phœbe Childers (G. Lapham)	2	2	3	1	1	1
Dione (C. D. Jeffries)	1	1	2	2	3	3
Dolly Dillon (M. Sanders)	3	3	1	3	2	2

Time—2:10¾, 2:12½, 2:12¼, 2:13¼, 2:13¼, 2:14¼.

RACE NO. 48—RUNNING.

The Sunny Slope Stake; for two-year-old fillies. Five furlongs. Entrance, $10, to accompany nomination; $15 additional if not declared by 4 P. M. the day preceding the race; $300 added by the Society, of which $50 to second and $25 to third. Weights 5 lbs. below the scale. A winner of a stake race in 1900, or a winner of three or more races of any value, other than selling races, 5 lbs. extra. Non-winners of two races allowed 4 lbs. Maidens allowed 7 lbs., and if such are the produce of a mare that has not produced a winner at the time of starting, 10 lbs. Maidens beaten three or more times since closing of the stake, allowed 5 lbs., and if not placed second or third, 7 lbs. additional. Closed with twenty-four entries. Value of stake, $630.

1. Gill Summers's b. f. Bavassa (2), by Imp. Bassetlaw—Bavaria; 110 lbs.
2. G. W. Trahern's b. f. All Silk (2), by Rear Guard—Miss Garvin; 100 lbs.
3. A. J. Stemler & Co.'s ch. f. Eonic (2), by Eon—Mermaid; 110 lbs.

4. Burns & Waterhouse's b. f. Spainwar (2), by Imp. Artillery—Sweet Rose; 95 lbs.
5. J. Weber's b. f. Moonbright (2), by St. Carlo—Moonlight; 110 lbs.
6. J. H. Dolan's ch. f. Maresa (2), by Imp. True Briton—Mayette; 103 lbs.

SUMMARY.

Maresa (McDonald)	1
Moonbright (Ruiz)	2
Bavassa (Mounce)	3

Time—1:01½.

Race No. 49—Running.

The Capital City Stake; a handicap for three-year-olds and upward. One mile and a furlong. Entrance, $10, to accompany nomination, with $20 additional for horses not declared by 4 P. M. day preceding race; with $400 added by the Society, of which $70 to second and $30 to third. A winner of a race other than a selling race, after the weights are published, to carry 5 lbs. extra. Closed with twenty-seven entries. Value of stake, $830.

1. Budd Doble & Co.'s b. g. El Mido (4), by Sir Modred—Ethel; 110 lbs.
2. Matt Storn's b. f. Morinel (4), by Morello—Sunlit; 112 lbs.
3. W. B. Jennings & Co.'s ch. c. Asian (3), by Imp. Goldfinch—Lydia; 100 lbs.
4. A. J. Stemler & Co.'s b. c. Lou Rey (5), by El Rio Rey—Louise M; 95 lbs.
5. Elmwood Farm's b. h. Vincitor (6), by Imp. Brutus—Mollie H; 112 lbs.
6. W. B. Sink, Jr.'s ch. h. Formero (4), by Imp. Conveth—Formosa; 120 lbs.
7. The Abbey Stable's b. m. Jennie Reid (4), by El Rio Rey—Fonsetta; 101 lbs.
8. Gill Summers's ch. g. Herculean (3), by Imp. Watercress—Hana; 111 lbs.

SUMMARY.

Formero (Ruiz)	1
El Mido (Mounce)	2
Lou Rey (Stuart)	3

Time—1:54¼.

Race No. 50—Running.

For three-year-olds and upward. One mile. Selling. Purse $300, of which $50 to second and $25 to third. Winner to be sold for $700; if for less, 3 lbs. allowed on each $100 down to $200. Horses beaten at this meeting allowed 3 lbs. for each time beaten.

1. W. M. Murry's br. g. Casdale (4), by Faverdale—Castalia; 98 lbs.
2. J. S. Gibson's b. m. Snips (5), by Fellowcharm—Czarina; 104 lbs.
3. J. Touhey & Co.'s b. h. Briar Hill (5), by Duncombe—Brierbush; 107 lbs.
4. L. McArthur's b. g. Pilot (3), by Morello—Adelante; 97 lbs.
5. J. D. Dunn's b. g. Jack McCabe (4), by Capt. Al—Myrtle G; 98 lbs.
6. Matt Storn's b. g. Sunello (3), by Morello—Sunlit; 100 lbs.
7. W. L. Stanfield's ch. g. Toribio (5), by Apache—Marin; 107 lbs.
8. J. Martin, Jr.'s b. f. Petal (5), by Oscar—Little Rose; 95 lbs.
9. C. R. Thompson's b. g. Sea Spray (a), by Mariner—Marin; 104 lbs.
10. M. A. Forster's b. g. Rey del San Juan (4), by Dan M. Murphy--Zingerella; 101 lbs.

SUMMARY.

Toribio (Stuart)	1
Snips (Butler)	2
Casdale (Mounce)	3

Time—1:41¼.

FRIDAY, SEPTEMBER 14, 1900.

Race No. 51—Trotting.

For three-year-olds and under (2:25 class). $50 entrance, of which $10 must accompany nomination; $15 payable July 1, and the remaining $25 payable August 15, 1900. $300 added by the Society. Closed May 15th with five entries, of which three made final payment. Total paid in, $185.

1. Hogoboom & Kingsbury's (Marysville) b. f. Eulah Mc, by McKinney—Balance All.
2. La Siesta's Ranch (San José) b. g. The Roman, by McKinney—Wanda.
3. J. B. Iverson's (Salinas) br. f. Dagmar, by McKinney—Dam by Steinway.

SUMMARY.

The Roman	w. o. for stakes paid in.

Time—2:22½.

RACE NO. 52—PACING.

2:21 class. Purse, $600. Mile heats, three in five.

1. W. P. Meredith's (Tombstone) br. h. Wopolo, by Tom Hal, Jr.—Dolly M.
2. Frank Wright's (Sacramento) b. g. Peo, by Fern—Sunflower.
3. B. F. White's (Dillon, Mont.) b. m. Ratatat, by Copper King—Latatat.
4. W. G. Durfee's (Los Angeles) ch. m. Cleon, by Happy Prince—Dam by Inca.
5. Ben Rush's (Suisun) b. h. Demonia, by Chas. Derby—Bertha.
6. W. Bemmerly's (Woodland) b. m. Carrey B, by Alexander Button—Carrey Malone.
7. I. L. Borden's (San Francisco) ch. g. N. L. B., by Diablo—Alice Bell.
8. Vendome Stock Farm's (San José) ch. g. Fredericksburg, by Nephew, Jr.—Minnie Hubbard.
9. J. M. Lipson's (San Bernardino) br. h. Zaloch, by McKinney—Gazelle.
10. M. Hart's (San Francisco) br. m. Hermia, by Soudan—Hattie.

SUMMARY.

Zaloch (J. M. Lipson)	2	1	1	1
Fredericksburg (C. T. Bunch)	1	2	2	2
Hermia (R. Havey)	3	3	3	3
Cleon (W. G. Durfee)	dis.			

Time—2:12, 2:14, 2:18, 2:16¾.

RACE NO. 53—RUNNING.

For two-year-olds. Six furlongs. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $800; if for less, 3 lbs. allowed for each $100 down to $200. Winners at this meeting to carry 5 lbs. extra. Beaten maidens allowed 10 lbs.

1. W. M. Murry's b. g. Loyal S (2), by Imp. Loyalist—Tillie S; 90 lbs.
2. G. W. Trahern's b. g. Bill Young (2), by Rear Guard—Blue Bonnet; 100 lbs.
3. Alameda Stable's b. f. Location (2), by Imp. Prospector—Venezia; 90 lbs.
4. W. B. Jennings & Co.'s b. c. Canmore (2), Imp. Midlothian—Fannie Louise; 105 lbs.
5. Thomas Fox's br. f. Screenwell Lake (2), by Imp. Artillery—Lake County; 97 lbs.
6. D. S. Fountain's b. g. George Dewey (2), by General Miles—Georgia; 96 lbs.

SUMMARY.

Canmore (Ames)	1
George Dewey (Mounce)	2
Screenwell Lake (Gaffney)	3

Time—1:15¼.

RACE NO. 54—RUNNING.

For three-year-olds and upward. Six furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $300.

1. Martin Duffy's b. h. Phlegon (3), by Imp. Piccolo—Little Rose; 105 lbs.
2. A. J. Stemler & Co.'s ch. g. Lodestar (a), by Imp. Midlothian—Starlight; 112 lbs.
3. J. McCarty's b. g. Almoneer (4), by Imp. Midlothian—Charity; 112 lbs.
4. Halford & Corey's b. h. Harry Gwynn (6), by Pontico—Nellie Gwynn; 112 lbs.
5. J. Crane's b. g. Amasa (a), Capt. Al—Lady Intruder; 112 lbs.
6. Alameda Stable's b. f. Lobosina (3), by Golden Garter—Tremblor; 105 lbs.
7. S. Tryon's ch. g. Galene (3), by Imp. Brutus—Pickwick; 105 lbs.
8. W. Holmes's ch. g. Fine Shot (3), by Balgowan—Dignity II; 105 lbs.

SUMMARY.

Amasa (Frawley)	1
Lodestar (Halfey)	2
Almoneer (McCarty)	3

Time—1:15.

RACE NO. 55A—RUNNING.

For maiden three-year-olds and upward. Six furlongs. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $300. All to carry 110 lbs. No sex allowance. Maidens beaten at this meeting allowed, if not placed second or third, 7 lbs.

1. W. Maben's b. m. Miss Vera (3), by Amigo—Fame; 110 lbs.
2. Elmwood Farm's b. g. Formatus (3), by Imp. Brutus—Forma; 103 lbs.
3. W. M. Murry's ch. f. Abbyleix L (3), by Loyalist—Tillie S; 110 lbs.

4. Alameda Stable's b. g. Trevathan (3), by Bassetlaw—Mercedes; 110 lbs.
5. Ed. Lloyd & Co.'s ch. g. Hiram Johnson (3), by Flambeau—Charm; 103 lbs.
6. C. P. Fink's b. f. Swiftwater (3), by Imp. Candlemas—Ripletta; 103 lbs.
7. A. B. Spreckels's b. m. Nihau (5), by St. Saviour—Yarranabee; 103 lbs.
8. J. W. Donathan's b. g. Frank Woods (3), by Gano—Aunt Betsy; 110 lbs.
9. Miss M. O'Connell's ch. g. Judge Shropshire (3), by Tom Paxton—Helen Beandcroft; 110 lbs.
10. W. P. Fine's b. g. Onyx (4), by Friar Tuck—Fleetwing; 110 lbs.
11. J. Gibson's b. g. John Boggs (3), by Friar Tuck—Czarina; 110 lbs.
12. Owen Bros.' b. g. Vigilant (3), by Capt. Al—Mamie R; 110 lbs.
13. O. A. Martin's b. g. Redsteel (4), by Red Iron—Lily S; 110 lbs.
14. S. F. Capp's gr. g. Grey Bob (3), by Friar Tuck—May Day; 110 lbs.

SUMMARY.

Swiftwater (Mounce)	1
Frank Woods (Butler)	2
Trevathan (Ruiz)	3

Time—1:15½.

RACE No. 55—RUNNING.

For three-year-olds and upward that have started at this meeting and not won. Seven furlongs. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $300.

1. J. J. Moran's ch. c. Bathos (3), by Imp. Bathampton—Crisis; 105 lbs.
2. E. Lloyd & Co.'s ch. g. Cæsar Young (3), by Hanover—Mollie Seabrook; 100 lbs.
3. W. B. Jennings & Co.'s ch. c. Redwald (3), by Tenny—Imp. Redworth Rose; 107 lbs.
4. E. E. Edwards's ch. g. Merry Boy (6), by Imp. Merriwa—Lizzie Hooker; 111 lbs.
5. J. Crane's b. m. Dolore (a), by Wild Idle—Rosette; 112 lbs.
6. Ward Adams's b. m. Loconomo (5), by St. Saviour—Lillie W; 108 lbs.
7. Dan Morgan's b. g. McFarlane (a), by Mariner—Moonlight; 113 lbs.

SUMMARY.

Merry Boy (Ruiz)	1
Bathos (Butler)	2
Loconomo (Narvaez)	3

Time—1:28.

SATURDAY, SEPTEMBER 15, 1900.

RACE No. 56—TROTTING.

2:30 class. Purse, $1,000. Mile heats, three in five.

1. Wm. Morgan's (Los Angeles) b. m. Una K, by McKinney—Unknown.
2. S. C. Tryon & Co.'s (Sacramento) b. m. Princess Wilkes, by Clarence Wilkes—Dam by Dexter Prince.
3. E. J. Lane's (Everett, Wash.) b. m. Mary L, by Maine Hero—Dam by Kentucky Whip. (?)
4. L. Zimmerman's (Portland, Or.) b. g. McBrier, by McKinney—Brier Bell.
5. C. P. Chamberlain's (Rossland, B. C.) g. g. Greyling, by Hambletonian Mambrino—Lady Grey.
6. Nutwood Stock Farm's (Irvington) b. g. Bob Ingersoll, by Nutwood Wilkes—Lou G.
7. W. Maben's (Los Angeles) blk. h. Santa Anita Star, by Guy Wilkes—Dam by Sultan.
8. W. G. Durfee's (Los Angeles) blk. g. Charlie Mc, by McKinney—Dam by Doncaster.
9. J. R. Albertson's (Marysville) r. g. Dan W, by Hero—Dam by Mambrino Prince.
10. P. Henshaw's (Chico) b. g. Monte Carlo, by Mendocino—Dam by Tilton Almont.
11. Valencia Stock Farm's (Los Angeles) br. m. Bet Madison, by James Madison—Betsy Trotwood.

SUMMARY.

Charlie Mc (W. G. Durfee)	5	1	1	2	1
McBrier (J. W. Donathan)	1	2	2	3	3
Bob Ingersoll (W. Cecil)	3	4	3	1	4
Bet Madison (C. Sanders)	4	5	4	4	2
Dan W (J. Albertson)	6	6	dr.		
Santa Anita Star (W. S. Maben)	2	3	5	dis.	

Time—2:16¼, 2:18, 2:17¼, 2:14¾, 2:20.

RACE NO. 57—PACING.

2:13 class. Purse, $1,000. Mile heats, three in five.

1. Charles Kapp's b. s. I Direct, by Direct—Francesca.
2. A. M. Waldon's b. h. Dave Ryan, by Antevolo—Network.
3. D. Hinds's br. h. John A, by Wayland W—Lady Moore.
4. A. L. Conklin's b. m. Edna R, by Sidney—Dam by Director.
5. C. Whitehead's blk. s. Delphi, by Director—Eddie.
6. J. B. Iverson's ch. m. Dictatress, by Dictatus—Salinas Belle.
7. H. W. Meek's b. h. Wm. Harold, by Sidney—Cricket.
8. H. H. Hellman's b. h. Wild Nutling, by Wildnut—Helea.
9. P. Henshaw's b. g. Fitz Lee, by Arthur Wilkes—Lady Merrill.
10. G. A. Davis's blk. h. Rey Direct, by Direct—Vera.

SUMMARY.

Delphi (C. Whitehead)	7	1	1	1
I Direct (E. Lafferty)	1	5	5	9
Wild Nutling (H. Hellman)	5	3	2	4
John A (J. Nelson)	4	2	4	5
Edna R (C. Trainor)	2	6	9	6
Rey Direct (E. Parker)	8	7	6	2
Fitz Lee (J. Sullivan)	9	9	3	3
Wm. Harold (B. Simpson)	3	4	8	7
Dictatress (C. Rodriguez)	6	8	7	8

Time—2:12½, 2:14¼, 2:15½, 2:16.

RACE NO. 58—RUNNING.

The California Annual Stake; for two-year-olds. Six furlongs. Entrance $10, to accompany nomination; with $20 additional for horses not declared by 4 P. M. day preceding race; with $500 added by the Society, of which $100 to second and $50 to third. Winners of a stake or three races other than selling races, 5 lbs. extra. Allowances: Non-winners of a stake, if a non-winner of three races other than selling races, 5 lbs.; of two races other than selling races, 7 lbs. Maidens at time of starting allowed 10 lbs., and if beaten three or more times and not placed second or third, 15 lbs. Closed with twenty-four entries. Value of stake, $810.

1. Thomas Fox's b. c. Phil Archibald (2), by Imp. Artillery—Flossy; 111 lbs.
2. J. Weber's b. f. Moonbright (2), by St. Carlo—Moonlight; 108 lbs.
3. Alameda Stable's b. g. St. Rica (2), by St. Andrew—Ricardo; 123 lbs.
4. Elmwood Farm's ch. c. Illilouon (2), by Tiger—Gipsette; 111 lbs.
5. W. C. de B. Lopez's b. c. Articulate (2), by Imp. St. Andrew—Imp. Utter; 108 lbs.
6. Gill Summers's b. f. Bavassa (2), by Imp. Bassetlaw—Bavaria; 108 lbs.
7. Burns & Waterhouse's b. g. Dunfree (2), by Imp. Duncombe—Free Love; 111 lbs.

SUMMARY.

Bavassa (Mounce)	1
St. Rica (Ruiz)	2
Articulate (Ames)	3

Time—1:14½.

RACE NO. 59—RUNNING.

The Favorite Stake; a handicap for three-year-olds and upward. One and one quarter miles. Entrance $15, to accompany nomination; with $25 additional for horses not declared by 4 P. M. the day preceding the race; $500 added by the Society, of which $100 to second and $50 to third. A winner of a race other than a selling purse, after the weights are published, to carry 5 lbs. extra. Closed with seventeen entries. Value of stake, $1,035.

1. Elmwood Farm's b. h. Vincitor (6), by Imp. Brutus—Mollie H; 111 lbs.
2. Matt Storn's b. f. Morinel (4), by Morello—Sunlit; 109 lbs.
3. The Abbey Stable's b. m. Jennie Reid (4), by El Rio Rey—Fonsetta; 99 lbs.
4. W. L. Stanfield's ch. g. Toribio (5), by Apache—Marin; 113 lbs.
5. J. J. Moran's b. g. Grand Sachem (5), by Tammany—Belinda; 95 lbs.
6. A. J. Stemler & Co.'s b. c. Lou Rey (5), by El Rio Rey—Louise M; 95 lbs.
7. Budd Doble & Co.'s b. g. El Mido (4), by Sir Modred—Ethel; 113 lbs.

SUMMARY.

El Mido (Mounce)	1
Morinel (Ruiz)	2
Grand Sachem (Ames)	3

Time—2:07¾.

Race No. 60—Running.

For three-year-olds and upward that have started at this meeting and not won two races at this meeting. Six furlongs. Purse $250, of which $50 to second and $25 to third. Weight 10 lbs. below scale. Beaten non-winners allowed 3 lbs. for each time beaten at this meeting. Winner to be sold for $300.

1. The Abbey Stable's ch. m. Mocorito (5), by Amigo—Santa Monica; 109 lbs.
2. I. H. Mulholland's ch. g. Limber Jim (a), by Snuffbox—Mildew; 106 lbs.
3. W. R. Larzelere's br. m. Jingle Jingle (4), by Imp. Brutus—Nabette; 103 lbs.
4. Owen Bros.' b. f. Flush of Gold (3), by Royal Flush—Gold Cup; 91 lbs.
5. E. E. Edwards's ch. g. Merry Boy (6), by Imp. Merriwa—Lizzie Hooker; 112 lbs.
6. J. S. Gibson's ch. m. February (a), by St. Carlo—Sister to Ruth Ryan; 103 lbs.
7. J. D. Dunn's b. g. Pompino (4), by Puryear D—Sweet Peggy; 112 lbs.

SUMMARY.

February (Butler)	1
Mocorito (Powell)	2
Merry Boy (Ruiz)	3

Time—1:14.

Race No. 60a—Running.

One and one sixteenth miles. Selling. Purse $250, of which $50 to second and $25 to third. Winner to be sold for $800; if for less, 3 lbs. allowed on each $100 down to $200. Horses beaten at this meeting allowed 2 lbs. for each time beaten.

1. J. J. Moran's ch. c. Bathos (3), by Imp. Bathampton—Crisis; 89 lbs.
2. S. F. Capps's ch. g. Rapido (a), by Cyclone—Wanda; 104 lbs.
3. M. J. McCune's b. g. None Such (5), by Keyser—Edith B; 101 lbs.
4. P. Moore's ch. m. Alicia (a), by Malcolm—Viney; 99 lbs.
5. C. R. Thompson's b. g. Sea Spray (a), by Mariner—Marin; 102 lbs.
6. Elmwood Farm's br. g. Edgardo (3), by Tiger—Lucia di Lammermoor; 97 lbs.
7. Miss M. O'Connell's b. g. Tenrica (5), by Tenny—Princess Fredrica; 100 lbs.

SUMMARY.

Bathos (Logue)	1
Alicia (Butler)	2
Edgardo (Mounce)	3

Time—1:48.

SCORES ON BUTTER EXHIBITED AT CALIFORNIA STATE FAIR, 1900.

JUDGES—LEROY ANDERSON, W. H. ROUSSEL, AND W. D. MCARTHUR.

FRUSH TUB BUTTER.

EXHIBITOR.	ANDERSON.					ROUSSEL.					McARTHUR.					Av.
	Fl.	Gr.	C.	S.	P.	Fl.	Gr.	C.	S.	P.	Fl.	Gr.	C.	S.	P.	
Danish Creamery, Fresno.	48½	25	10	10	5	48½	25	10	10	5	48½	25	10	10	5	98½
Sunset Creamery, Loleta.	49	24¾	9½	10	5	49	24¾	9½	10	5	48½	24½	10	10	5	98⅙
Point Arena Creamery, Point Arena.	49	24½	9¾	10	4½	48½	24¾	10	10	5	48½	24	10	10	5	97¾
Soren Iverson, Point Arena.	48	24½	9¾	10	4½	48½	24½	10	10	5	48½	24½	10	10	5	97$\frac{7}{12}$
Spring Brook Creamery, Sierraville.	49½	24½	9½	10	4½	49	24¼	9	10	4¾	48	24	10	10	5	97½
Hollister Creamery, Hollister.	48	25	9½	10	4¾	47½	24½	9½	9¾	5	49	24¼	10	10	5	97¼
Hydesville Creamery, Hydesville.	48	24½	9¾	10	4½	48½	24½	10	10	4½	47¾	24	10	10	5	97
Stockton Creamery, Stockton.	49	23¾	9¾	10	5	48	24¾	9¾	9½	5	48	23½	10	10	5	97
Sheppard Creamery, Point Arena.	48½	24½	9	10	4½	48	24½	9½	9¾	5	48½	24	10	10	5	96$_{12}$
Woodland Creamery, Woodland.	48½	24	9½	10	4¾	47½	24¾	9¾	9½	5	48	24½	10	10	5	96$\frac{11}{12}$
Penn Valley Creamery, Rough and Ready.	49	23½	9	10	4½	48	24¾	9½	9	5	48¾	24½	10	10	5	96⅚
Oak Leaf Creamery, Bolsa.	48	24	9¾	10	4¾	49	24	9¼	10	5	47½	24	10	10	5	96¾
Knights Landing Creamery, Grafton.	48	24¼	10	10	4¼	47½	24½	10	10	4½	48	24	10	10	5	96⅔

FRESH TUB BUTTER—CONTINUED.

EXHIBITOR.	ANDERSON.					ROUSSEL.					McARTHUR.					AV.
	Fl.	Gr.	C.	S.	P.	Fl.	Gr.	C.	S.	P.	Fl.	Gr.	C.	S.	P.	
Manchester Creamery, Manchester.	48	24	9½	10	4	48	24½	9¾	10	4½	48	24½	10	10	5	96 7/12
Eel River Creamery, Ferndale.	48½	24½	8¾	10	4¾	48	24½	9	10	4¾	48½	24	9½	10	4¾	96½
Castroville Creamery, Castroville.	48½	23½	9½	10	4½	48½	24½	10	10	4½	48	23	10	10	5	96½
Verona Creamery, Verona.	47½	24	9½	10	4½	48½	24½	9¼	9¾	4½	48	23½	9½	10	5	96
Pillarcitos Creamery, Half Moon Bay.	48	23½	9½	10	4¼	48½	24¼	9½	9¾	4	47½	24	10	10	5	96
Riverside Creamery, Ferndale.	47	24	10	10	4¼	47½	24	9½	9½	4½	48	24	10	10	4¼	95⅔
Clearwater Creamery, Hynes.	48	24	9	10	4½	47½	24½	9½	9	4½	48	23¾	10	10	5	95¾
Watsonville Creamery, Watsonville.	48	23	9	10	4½	48	24½	10	9½	4¾	47½	23¼	9	10	5	95⅓
Dixon Creamery, Dixon.	47	23	9½	10	4½	48	24½	9½	9¾	4¾	47½	23½	9½	10	5	95⅓
Alton Creamery, Alton.	48	23	9½	9½	4	47	24	8½	10	4	49	24½	9½	10	5	95⅙
Grizzly Bluff Creamery, Waddington.	48	24	8¾	10	4	48	24	9½	9¾	4½	46	23	10	10	4¾	95 1/12
River View Creamery, Rio Vista.	47	24	8½	10	4¼	48	24	8½	10	4½	46	23	9	10	4½	93¾
Acme Creamery, Newman.	47½	22½	9	10	4	47	24	9	9½	4	47	22½	9½	9½	4½	93⅙
Smith Creamery, Los Angeles.	47	23	8	10	4	47	23	8¾	9½	4½	47	23½	8	10	5	92¾
New Era Creamery, Newman.	46½	23	9	10	3¾	46	23½	8¼	10	4	47½	23	9	9	5	92½

COLD STORAGE BUTTER.

EXHIBITOR.	ANDERSON.					ROUSSEL.					McARTHUR.					Av.
	Fl.	Gr.	C.	S.	P.	Fl.	Gr.	C.	S.	P.	Fl.	Gr.	C.	S.	P.	
Hollister Creamery, Hollister.	48¼	24½	9½	10	4½	47½	25	10	10	4	46	24	10	10	5	96 1/12
Edenco Creamery, Petaluma.	47	24	10	10	5	46	24½	10	10	5	46	24	10	10	5	95½
Knights Landing Creamery, Grafton.	47½	23¾	10	10	4¾	47	24¾	10	10	4¾	45	24	10	10	5	95½
Pillarcitos Creamery, Half Moon Bay.	47	24	9¾	10	4¾	45	24	9½	10	4½	46	24	10	10	5	94½
Bodega Creamery, Bodega.	45	24	9½	10	4½	46	24½	10	10	4½	45	23½	10	10	5	93⅚
Fallon Creamery, Fallon.	46½	23	8½	10	4¼	45	24	8½	10	4½	43	22½	8½	10	4½	90 11/12

EXPORT PACKAGES—TINS.

Brigham, Hoppe & Co., San Francisco	Silver Medal.
Dairymen's Union, San Francisco	Bronze Medal.
Hilmer & Bredhoff, San Francisco	Diploma.

CHEESE.

Robert Nichols, Sheldon	Fl. 35	Gr. 27	C. 15	S. 10	P. 5	Av. 92
(Standard)	40	30	15	10	5	

POULTRY CULTURE.

By H. BERRAR, of San José.

Few people realize the importance of this industry, and it will be a matter of surprise to many to learn that it has risen to second place in the list of industrial economics. Its massive figures astound the statistician of industrial art. To-day this industry represents as annual output and stock on hand the enormous sum of $690,000,000.

To the average individual the poultry business is as a sealed book. Not only the legislature but the press fails in giving this industry proper recognition and support. Daily reports of the condition of the wheat, tobacco, and cotton crops, etc., are printed and read throughout the land, but no systematic reports of progress made in poultry culture are recorded. The growth of the poultry industry is one of the most reliable and conclusive proofs of the prosperity of this country, and the American hen must be recognized as one of the most potent factors in producing and maintaining the wealth of our country.

The estimated value of the entire cotton crop for the year 1899 was less than $300,000,000, while the approximate value of the poultry business of the United States alone was nearly three times that amount and more than twice the value of all the milk and butter produced.

Poultry will yield quicker and larger returns than any other department of farming, and every year shows an increase in our importations of eggs and fowls. Our poultry farmers should be sufficiently strong to supply our home markets.

In many of our Eastern States practical lessons in poultry culture are taught, but in this State little encouragement is offered poultrymen. Utah, Rhode Island, New York, Illinois, and other States supply their poultrymen with bulletins and pamphlets free of charge, describing in full experiments that have been conducted by practical men.

It seems strange that this State is so slow to recognize the importance of this industry. An Experiment Station should be established and a liberal appropriation made for poultry work, so that poultrymen could take a special course of instruction in poultry culture, scientific breeding, etc. The interests of poultrymen should at least receive as much consideration as that of hucksters and horticulturists.

It is a fact that the progeny of the scrub fowl is of all degrees of shape and color, lacking in uniformity of size and quality of flesh. In this enlightened age there is no excuse for this sort of productions, particularly as it is an established fact that pure-bred fowls grow evenly, develop fully, dress alike, and are of uniform quality.

This State possesses ideal conditions for the breeding of fowls, and experiments should be conducted scientifically to determine:

1. What constitutes a well-balanced ration for different breeds in different climates.
2. How to combine various foods so that proteins, fats, and carbohydrates may be in proper proportion.
3. To test labor and time saving devices, and to determine how best results may be attained.
4. How, when, and what to feed.
5. To test appliances for determining egg records of individual fowls.
6. To study the methods of heating and ventilating poultry houses, brooders, and brooder houses, and to discover a most practical and successful system of brooding.
7. To perfect the science of incubation and to investigate the causes and methods for prevention of mortality in incubator chicks.
8. To investigate the causes of poultry diseases, their cure, prevention, and methods of treatment.
9. To experiment with the different varieties as to cost of egg production and value as market fowls.
10. To note results of crossing different breeds, their utility, beauty, and commercial value.
11. To determine what are the laws of breeding, fancy breeding, line breeding, etc.
12. How to increase egg yield, methods of storing, preserving, assorting, grading, etc.
13. To dissect, observe, and discover anything and everything that would assist in the promotion of this industry.

American breeders are to-day producing the best table poultry in the world. The most favored breed for market is select stock which dress out yellow, flesh firm, fine flavored, sweet, and juicy, small bones, large proportion of white meat, the breast being large and full.

The Agricultural Department of the Canadian Government is establishing fattening stations throughout that country for the purpose of encouraging the industry of chicken fattening for the British market. These stations are intended to illustrate the best methods of carrying on the enterprise by showing the farmers the proper way to fatten chickens by using special food, also the killing, dressing, and packing for shipment.

Incubators.—There are now about sixty-five factories in the United States and Canada. The incubator has revolutionized commercial poultry culture. But for it the industry could never have reached its present magnitude. The incubator is no longer an experiment; it has come to stay and has increased the chances of success, and progress is made more rapid and certain.

Poultry Supplies.—Our poultry supply firms are doing an immense business. Some of our manufacturers have achieved a world-wide reputation. A glance at their order files would prove a revelation to many who do not realize the importance of this branch of the industry. Hundreds of first-class mechanics are employed and machines shipped to all parts of the world.

Packing-Houses.—The capacity of some of the largest is from one to six thousand chickens per day, and it is interesting to note that about three cents per pound more is paid for pure-bred fowls than for common stock.

Picking Chickens.—A recent invention. The fowl, after being killed, is placed in a receptacle, and into this is turned several cross currents of air from electric fans revolving at a high rate of speed. The fowl is instantly stripped of its feathers, even to the tiniest particles of down.

The Hen.—Modern brain and enterprise have developed the most unimportant adjunct to the farm into the best paying element of agricultural investment. A flock of fowls forms a most valuable adjunct to fruit-growers. Aside from the valuable service rendered in an orchard, they will give a daily revenue, at a nominal cost, as they will pick up most of their food.

Market.—There is never a time when eggs and fowls do not command a market. At an average price, eggs are about the cheapest and most nutritious article of diet.

Eggs.—The estimated value of eggs marketed during the past year is $135,000,000. The demand increases faster than the supply. In addition to the eggs produced in the United States, we import about one hundred millions each year. Hundreds of thousands are used in the industrial arts; as, for instance, in dressing leather, in treating photographs, in fixing colors in printing dress goods, in clarifying wines, etc.; also, for medical purposes to cure burns, prevent blistering, sore throat, inflamed bowels, etc.

Dried Eggs.—Vast quantities of eggs are now dried and put on the market. The eggs are broken into a churning machine and are thoroughly churned up, then evaporated and dried. They keep perfectly and taste precisely like fresh eggs. This new industry offers a vast field for enterprise and capital, as the demand for dried eggs, particularly in Alaska, on the frontiers, and on board ship, is increasing rapidly and is practically unlimited.

Assorting and Grading Eggs.—This is done by candling and is a trade. All large commission houses employ expert candlers. The method consists in inclosing a gaslight in a metal box from which the light is thrown as from a searchlight. The egg, held between the thumb and forefinger, is placed in the light and turned round and round and thoroughly inspected.

A fresh egg presents a yellow glow; the shell is full, the yolk in the middle, and the white is perfectly transparent.

A second class egg is shrunken so as to leave an air chamber at the small end.

A third class egg is streaked with red, or the yolk seems to be breaking up.

A bad egg contains black spots; it is opaque, no light being visible through its density.

Storing Eggs.—An immense business is being done in storing eggs; they are purchased when the market is low, only the cleanest and freshest are selected, and after being candled are placed in new cases, which are placed in storage rooms where a temperature of 31° Fahr. is maintained. Kansas City alone stored about 1,500,000 eggs last year. Pacific Coast cities are the recipients of hundreds of carloads of eggs, and live and dressed poultry, representing expenditures of about $2,000 per car.

Advice to Beginners.—Our universities are turning out hundreds of intelligent young men each year. It is a puzzle to many of them what shall be their chosen field of work. Particularly is this true of many who are possessed of limited means and without influential friends to assist them to a paying position. To these latter particularly I would say: Study the science and art of incubation, brooding, and egg production. There is no other industry which offers a more independent and enjoyable way of earning a livelihood. Become a specialist in this line; give the subject the same study and time that you would expend in preparing for any other profession; study the experiences of others in good poultry journals; learn how to produce first-class stock in every way. Great success will be best attained by those who have a natural love for and devotion to this kind of labor.

At this time, when the nations are looking to the Orient for a market for their manufactured products, it is a relief to the beginner to know that there is no fear of this profession being overdone, as there is an unlimited home market for poultry products. The demand is so much greater than the supply that there need be no fear of an overproduction.

General Advice.—The general advice of experienced specialists is: Buy stock and save time, follow one line of breeding, and study the methods of expert breeders; subscribe for one or more first-class poultry journals; purchase a copy of the American Standard. Start with the best variety of stock obtainable, and familiarize yourself with the standard requirements.

The State Agricultural Society has accomplished much in advancing this industry. The display of poultry the past few years showed a marked improvement over previous exhibits, particularly in quality, number of fowls exhibited, and general management.

The magnificent and varied display of rare and practical qualities of fowls shown, the increase in number, and the interest and zeal of the members of the various poultry associations is conclusive proof of the good influence of poultry shows. No one is satisfied to keep common hens after having visited a good poultry show; hence, the fact is conceded that our winter shows and State fairs are practical educators, not only for breeders but for the public in general, and animate the first desire of many beginners.

This State offers ideal conditions for poultry-raising, and while there are many plants representing investments of thousands of dollars, still the demand for poultry and eggs is so great that an independent living would be assured to thousands of families who should enter this business to supply our local markets.

The man who embarks in the poultry business in this State has climate, soil, and market to his advantage.

The universality of poultry culture places it beyond the reach of syndicates and trusts, and the beginner need not be deterred from entering the profession through fear that the wealthy will gain control of the industry and force him to the wall.

Years of study and patient toil are required before one can be admitted to a profession or become master of a trade. Before attempting to make poultry culture your sole support, master every detail of the business and your success will be assured.

There are many important phases of this industry not mentioned in this article. The people are willing and anxious to learn. It is the duty of the State to instruct. Let us hope that the legislature will see fit to afford the means and facilities, which will prove of lasting benefit to the universe.

NECESSITY OF IRRIGATION.

By WILLIAM THOMAS,
President of California Water and Forest Association.

Everybody recognizes the utility of irrigation, but few recognize its absolute necessity as a means of developing the great natural resources of the State. We have a territory to develop as large as that of the republic of France, capable of supporting a population as dense as that of Holland, but with an actual population about as large as that of the city of Chicago, and, to be frank even to the extent of being brutal, with one-tenth of its public spirit. I may hurt somebody's feelings, but I affirm that California's arrested development is due to the lack of interest and spirit of its citizens. Nature has done all that it can for us. We must do the rest, and the question now before us is, what can we do? Does the reader know that the Riverside Colony supports ten thousand people on thirteen thousand acres of land by an almost perfect system of irrigation? That Fresno provides happy homes for twenty-five thousand people on one hundred thousand acres? That the Sacramento Valley, with millions of acres of the fairest land in the world, has enjoyed no increase in population (except in cities) and no increase in the assessable value of this land during the past ten years? These examples prove not only the utility, but the actual necessity of irrigation, in order to effect the future development of the State as a whole. I have heard it said that the large individual holdings of land arrested the State's development; but if these holdings were cut up into colony lots, the occupants of the subdivisions would starve without irrigation, and most of the large holdings are not irrigated.

Can we not wake the citizens from their present lethargy? Can we not induce them to take hold of this serious problem, as a whole, and prevent our State from being ranked as one of the arid States, as it will certainly be ranked within thirty years unless we do something to develop the water resources which lie at our door ready and willing to be utilized? We can more than double our population in ten years if we do something. If we do nothing our rural population will drift toward the cities, which cannot support them if agriculture proves unsuccessful. Develop the country, and the cities will develop themselves. The Orient has just been opened to us as a new market for our products, and now is the time for us to do something, and the first thing to do is to develop our water resources. We are now using all the water which flows naturally in our streams, and we see our crops fail year after year from drought and frosts. We must develop more water, stand still, or go backward. There is no alternative.

More water can be developed in three ways:

First—Increase in natural rainfall (and diminution of frosts) by preserving the trees which are left, and by replanting denuded lands.

Second—Storage of the flood or winter waters, which now flow into the ocean, doing nobody any good and most of us harm.

Third—Utilization of our vast underground supply, by pumps operated by electrical power generated either in our mountain streams, or by our new natural fuel—crude oil.

Forests.—So much of our forest land has passed into private hands that the forestry question in this State is a serious but not an insurmountable one. The Federal Government should not sell another tree. Every acre of forest land should be reserved by it, and if any trees are cut on its lands for lumber, they should be cut under the direction of experienced foresters in such manner as to improve rather than destroy the property. This can, and, with the hearty coöperation of our citizens, will be done, for the Federal Government is keenly alive to the necessity of preserving the forest trees of this State.

But this is not sufficient. We need more forest lands, and as we cannot afford to buy timbered lands, why not go into the business of buying denuded lands, replanting them, and in the course of fifteen or twenty years, sell stumpage in such a manner as to pay expenses and probably a profit? Germany has done it, and is already fifty years ahead of us in internal agricultural improvement. She has thirty-five million acres of forest lands, manages them scientifically, and makes money out of them. She never cuts a tree without planting another. She has actually improved the productive capacity of her agricultural lands, and yet it takes forty years for her to develop a good-sized tree, where it would take us not more than fifteen. Other States, more wide-awake than ourselves and with less necessities, have bought denuded lands at from fifty cents to two dollars per acre, have replanted them, and are now managing them under approved rules of forestry. Why cannot we do the same? There is nothing the State needs so much as a complete non-partisan forestry system working in harmony, possibly in partnership, with the Federal Government.

Flood Waters.—A large percentage of our annual rainfall is carried by our torrential streams to the sea. This does not belong to the riparian owner, but to the State. This should be impounded and used at seasons of low water. The investigations of the United States Geological Survey during the summer of 1900 showed the possibility of constructing storage reservoirs at an average cost of eight dollars per acre-foot, which renders such construction commercially possible. The capacity of the reservoir sites located by it in 1900 on the Kings River and Cache and Stony Creeks aggregated six hundred and sixty-five thousand acre-feet. Few people appreciate the fact that this water so stored would justify an increased population of from one hundred thousand to two hundred thousand people, would result in an increased value in the lands irrigated, after deducting cost of construction (five million dollars), of more than twenty million dollars, and would yield an annual income of about five hundred thousand dollars. Yet we sit down year after year and see these opportunities wasted, because of a lack of knowledge or of interest in the subject. If data like the above could be officially placed before foreign capital, the large holdings of unirrigated land might be cut up and irrigated from these sources, provided we passed such legislation as would encourage investments in these enterprises, rather than our present legislation which completely throttles all such investments.

Pumping.—The third method of developing irrigation requires no argument or extended explanation. In districts where subterranean flow exists, and where electrical power is available, generated either by water or oil, pumping is the most economical method of irrigation. It is cheaper to run a wire than to run a ditch.

Liberal legislation should be promptly enacted encouraging the investment of private capital in power plants.

To put into successful operation the second and third plans for developing irrigation, we must do one thing and do it promptly, and that is enact an entirely new code of irrigation laws. Elwood Mead, the recognized authority on irrigation laws and the head of the Irrigation Bureau of the Department of Agriculture, pronounces our present law as hopeless. No patching by way of amendment will cure the difficulties. We need a brand-new code on this subject. Under the irrigation code of Wyoming, drawn by Mead, but one lawsuit has appeared in the books. Our Supreme Court reports are filled with decisions, but how many irrigators consider their rights definitely settled? Fortunes have been spent in litigation. Fortunes must yet be spent if we go on under our present defective system. I heard an old farmer say once that among his assets were five injunctions secured against his neighbors at a cost of five thousand dollars, but which netted him not one drop of water. Is not that the experience of many of my readers? There is no remedy for this condition of affairs other than a new code. In order to bring about these reforms so necessary to the safety and welfare of the State, some unanimity of action is necessary. Citizens, no matter how public-spirited they may be, can do nothing if working individually or in detached bodies. In the fall of 1899 a number of public-spirited citizens organized the California Water and Forest Association, in which I hold the onerous and not very lucrative position of president. Its charter members numbered seventy-two; on January 1, 1901, it had on its rolls five thousand seven hundred members. Last fall it secured from the proper officers of the Federal Government a pledge to expend one hundred thousand dollars of Federal money during the next two years in investigating the water resources of the State, the possible reservoir sites, and their cost, and the best methods of preserving our forests, provided the State would appropriate an equal amount. The Association considered this offer of partnership an admirable one. A similar partnership had existed during the year between the Federal Government and the Association, the latter supplying one half of the money expended, through the liberality of public-spirited citizens, and the work done has been of incalculable value to the State. Senate Bill No. 7 was therefore introduced at the request of the Association, appropriating one hundred thousand dollars to be expended under the direction of three unsalaried Water and Forest Commissioners, but only in collaboration with the Federal Government, each to put up dollar for dollar. Twenty-three Chambers of Commerce, Boards of Trade, and like organizations, from Chico to San Diego, memorialized the Legislature to pass the bill. One Assemblyman and one Senator voted against it, but the bill was vetoed by Governor Gage. The veto was a severe blow to the progress of the Association. With this money we had hoped to make a thorough investigation of what was needed, and to report to the next Legislature a definite plan for the preservation of our forests and flood waters. There is now nothing to do but study methods, and wait. We cannot rely upon private subscriptions. The State must assume its share of the burden, but to get it to assume this share we must all work together. Every public-spirited citizen should join the Association, so that we may knock at the door of the next Legislature with twenty-five thousand members behind the summons, rather than five thousand. The membership fee and annual dues of one dollar bring membership within the reach of all.

WATER DEVELOPMENT, AND IRRIGATION FROM DEEP WELLS IN CALIFORNIA.

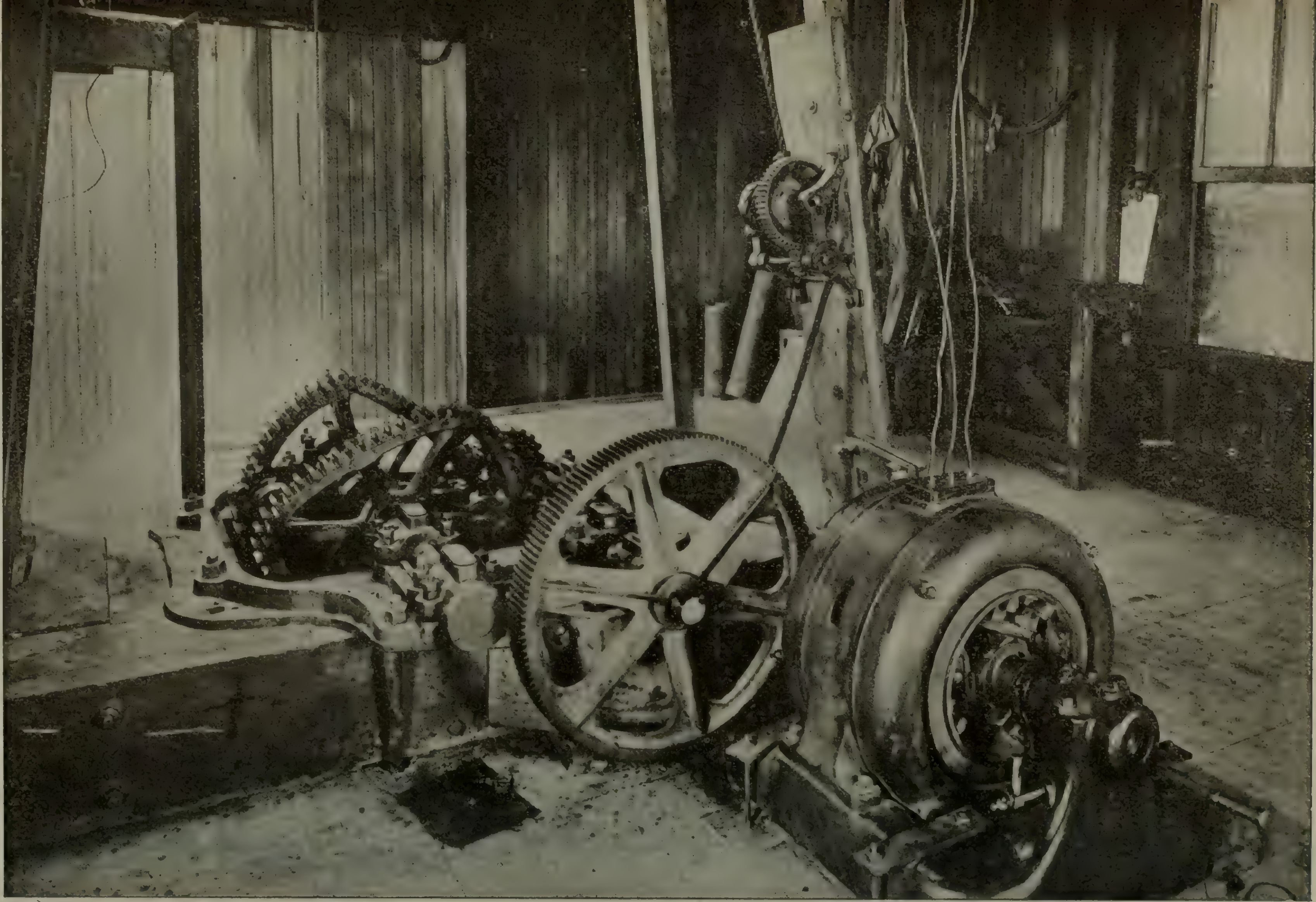
By A. T. AMES, of Galt.

Irrigation in California a few years ago was considered practical and profitable only when a gravity system could be constructed and carried out on a large scale, utilizing the water from mountain streams and conducting it in open ditches to the orchards and gardens on lands so located as to come under a gravity flow. This left a greater portion of the richest and most fertile land dependent entirely on winter rains for moisture, which, generally speaking here in California, particularly in the southern part of the State, is only sufficient to grow a crop of grain in the early spring, and grazing for stock. On land that only a few years ago was considered good for nothing else, and could not be depended upon for even that purpose, it was not thought possible to develop sufficient water in wells to irrigate more than a garden patch, and even if water in sufficient quantity to irrigate could be obtained from wells, it was supposed that the cost of pumping would make it impracticable, which was true to a great extent at that time.

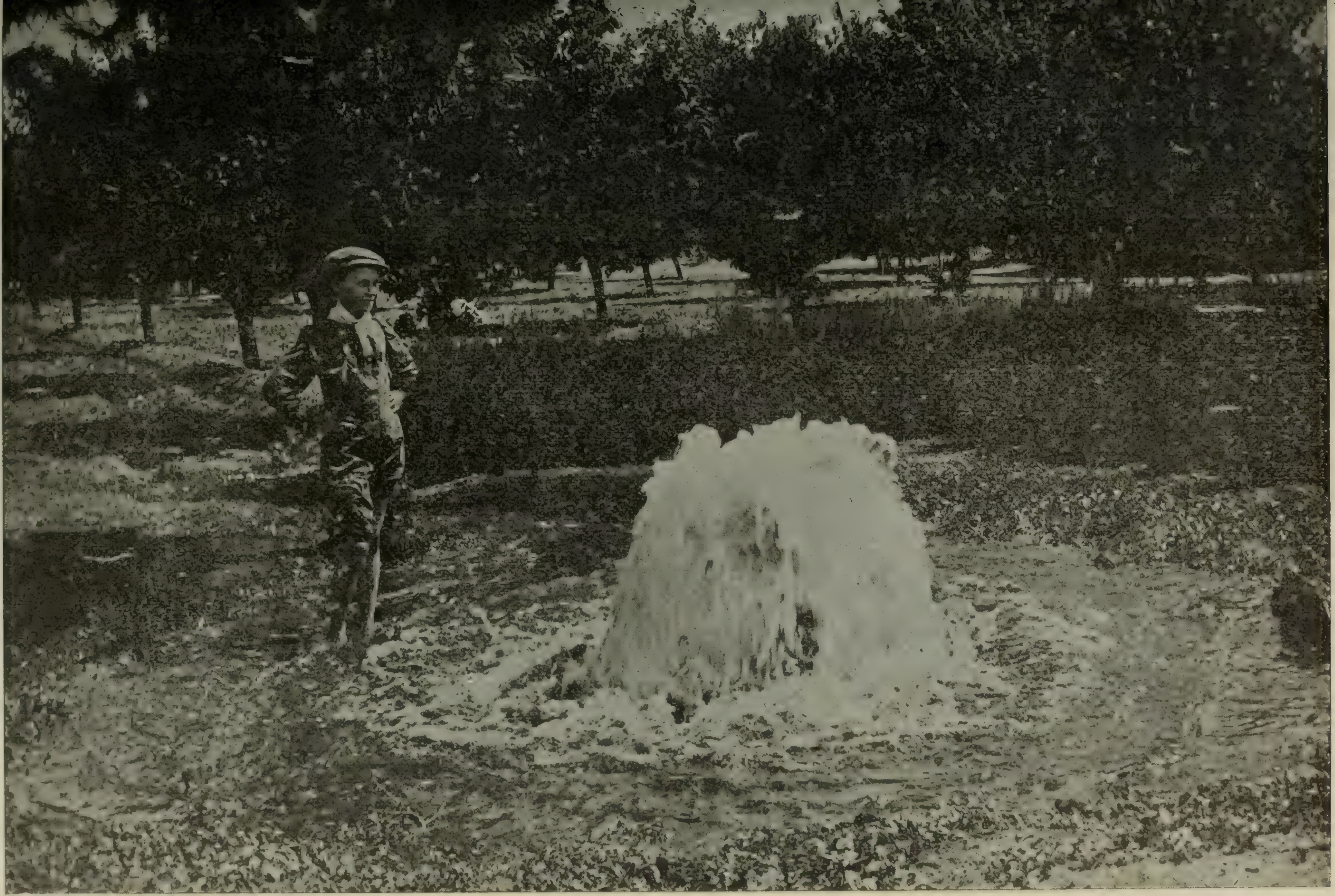
The past five years, however, have wrought wonderful changes. It has been proven beyond question that an inexhaustible supply of water underlies almost the entire country. Hundreds of wells have been bored or dug; crude oil has been found, and utilized for generating a cheap power in connection with gasoline and steam engines.

Great improvements have been made in deep-well pumps adapted to this class of work (viz: pumping an irrigating head from deep wells of small diameter), and I believe it to be a very conservative estimate that during the past two years more than a million dollars a year has been expended in *deep-well pumping machinery* for irrigation purposes. In Southern California alone there are now many thousands of miners' inches continuous flow pumped out of the ground from deep-bored wells for irrigation. Indeed, they in Southern California are getting very much more water out of the ground by pumping it from bored wells than they get from above. They get it at much less cost than from the gravity system, and get it just when they need it besides. The man with an improved pumping plant is independent of any one else; when his crop needs water he simply starts his pump.

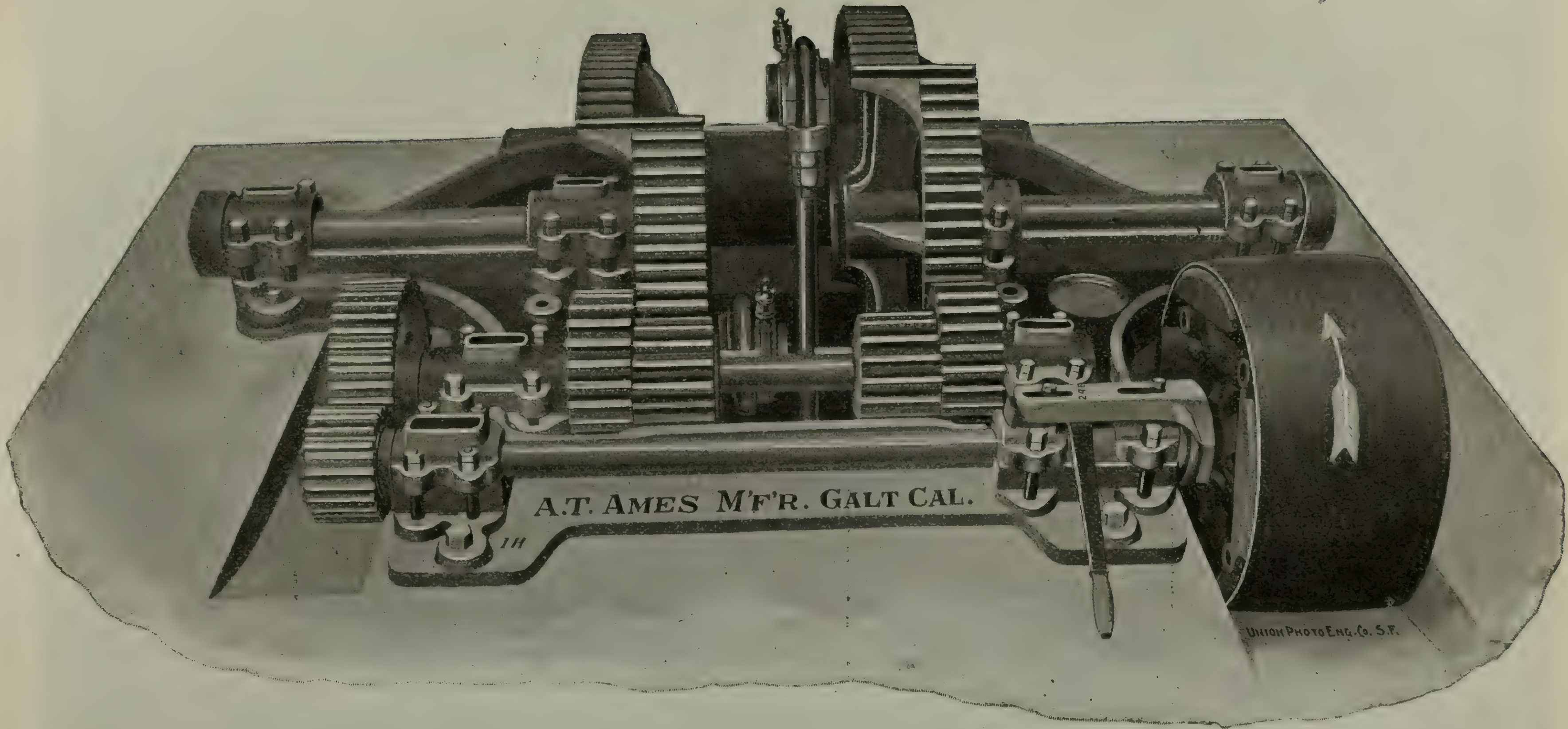
Pumps that are used in California for irrigation are divided into two classes: Where large quantities of water can be obtained near the sur-



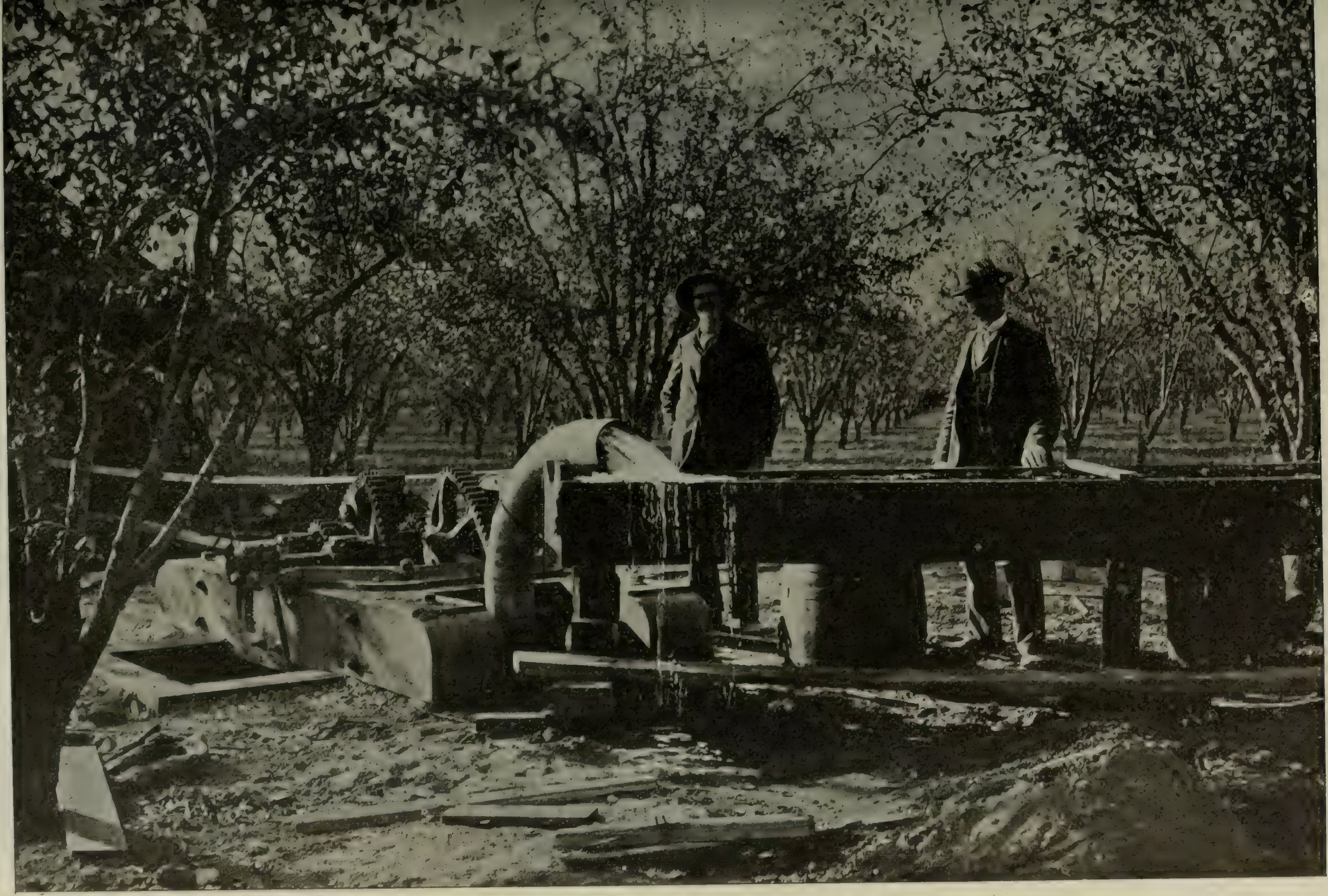
Deep-Well Irrigating Pump Driven by Electric Power.



This stream of water is pumped by deep-well irrigating pump, 112 feet to the surface, from a 12-inch bored well, and delivered in this orchard 30 feet above the pump through half a mile of pipe.

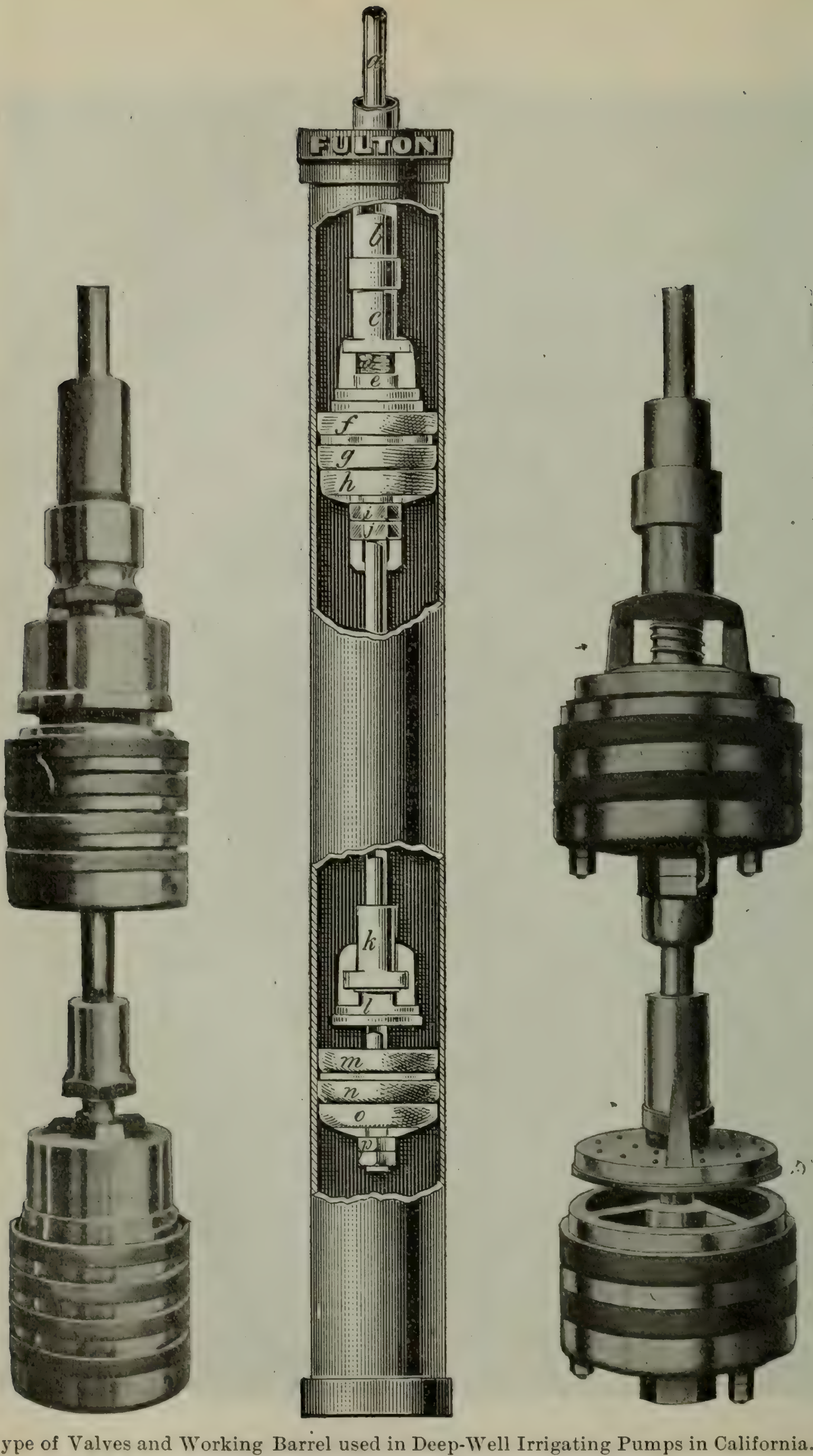


The Largest Deep-Well Irrigating Pump Made in the United States.
Capacity, 25,000 gallons per hour, at 250 feet lift from a 12-inch bored well. Shipping weight of power head alone, 9,000 pounds.



Pumping Plant of John Bollinger, San José, Cal.

Note the smile on this honest old German's face. He thinks he has the best system on earth.



Type of Valves and Working Barrel used in Deep-Well Irrigating Pumps in California.
These Valves are manufactured of the finest brass and phosphor bronze.

face, or within suction limit, vertical and horizontal, rotary and centrifugal pumps are used, owing to their great capacity and comparatively small cost; but under the most favorable conditions the best makes of this class of pumps rarely show an efficiency of more than 50 per cent.

For all deep work (beyond suction limit), where large quantities of water are wanted from deep wells of small diameter at the minimum cost for power, the *double plunger, continuous flow, cylinder pumps* are the best; the main reason being their high efficiency, from 75 to 85 per cent, depending on conditions.

THE BREEDING OF BEEF CATTLE.

By JAMES WHITAKER, of Galt.

During the past season the cattle industry has been a very profitable one to those who were able to hold their stock during the period of low prices and drought, which were the means of crippling the cattle business greatly. This, together with the fact that less consideration is given to exceedingly large herds and more attention to the infusing of better blood, has been the means of inspiring confidence in this branch of industry and causing a majority of the former breeders to again turn their attention in this direction, thereby encouraging the starting of many new herds. The industry is once more on a stable foundation, with every indication pointing to an improvement in the quality, good prices, and a supply not exceeding the demand.

To be a successful breeder of good cattle one must have a clear conception of what constitutes a good animal and the characteristics that make the real excellence of the herd. In beef type the first thing to consider is general beef form—low, broad, deep, and smooth, with the parts that give the best priced cuts evenly covered. The back and ribs should be particularly well covered: these parts fully developed are essential to make both good breeders and feeders. Besides form, the animal should possess a smooth, soft skin and heavy but fine coat. To a certain extent it should show some style or life, a clear eye and clean bones—all good signs of feeding quality. Extraordinary size is not necessary; it usually makes rough-boned, coarse animals. Confine yourself to medium size, with a vigorous constitution, which nearly always belongs to an animal with a broad forehead, good brisket, and full heart girth. The aptitude of the animal to take on flesh is vitally essential to the beef producer as well as to the show breeder, and while the fattest show cattle are not always the best breeders, it is a safe plan to follow closely their line of breeding, since the show breeders must necessarily be governed by the demands of the beef producers. Very frequently the fattest stock are sold first, simply because they appear much better than cattle which have not so much fat yet are in reality just as good.

Endeavor to see as many produce of the cow and get of the bull as possible. In this manner the value of the sire or dam as breeders is much better demonstrated. In young animals this cannot be done, and the individual must show for itself. When selecting a herd you cannot rely upon pedigree entirely; individual merit is an important factor. If fine pedigrees always made fine animals, breeders could raise such easily, by mating highly bred ones with those equally pure blooded. As a general rule "like produces like," yet there are exceptions. Ordinarily a very fine cow bred to a high-grade bull will produce a calf like its parents, still there are times when the blood of the two does not blend well and the result is a disappointment to the breeder; whereas, this same cow bred to another bull would produce a calf far superior. The raiser of good stock must give his strictest attention to the mating of his cattle; he may have the choicest animals to start with, but if he fails to give them thought his herd will surely degenerate.

Particular care should be used in the choice of a bull; his individuality will show itself in the entire herd, since his blood is really the vital and energy-giving force by which we better the breeding, while that of the cow is confined to her particular calf, consequently more easily eliminated from the herd than that of the bull should his offspring, as a whole, show any defective points. Don't keep a delicate animal; they are hard to care for and never raise their young with any profit to the producer.

Having obtained an excellent herd, the feeding of them is a problem requiring constant study. A set rule cannot be laid down as to quantity or kinds. A certain amount of feed or feeds, which would be the proper proportion for one, might not be at all suitable for another. Feeding is governed greatly by the natural and climatic conditions of the country. Every breeder cannot grow the many different varieties of feed, therefore he must ascertain what will do well in his locality, and more particularly on what his stock will thrive the best.

Give them plenty of water; you may get the best feed obtainable, and feed all the animal can eat, but without clean, fresh water, except the amount necessary to sustain life, it is virtually thrown away. More diseases are transmitted by means of impure water than in any other manner. Directly after the water is taken into the stomach, it enters the circulation, thus carrying the impurities to all parts of the system.

Stock should have some kind of shelter, even though it be a mere shed, to break the cold winds during the stormy season.

While it is true that in large herds each animal may not get the care it should, yet the herd taken collectively can be treated in a proper manner in the matter of food and care. Excepting show cattle, it takes no more expense to feed good cattle than poor ones. As a matter of fact, the good ones are the cheapest in the end.

It is sometimes no easy matter to decide which breed to carry. At the present time the Herefords are undoubtedly the most popular, and seem destined to hold the lead. They are hardy, uniform in size and color, mature early, and are easily handled. The range men are fast recognizing their merit as range cattle, and are taking the bulls as fast as they can be raised, at good prices.

ALFALFA.

Its Growth, Cultivation, Harvest, and Value as a Food.

ALFALFA-GROWING AND HAY-MAKING.*

By W. H. SHAFER, of Selma.

The word alfalfa is of Arabic origin, and was in use in Spain when the plant was introduced into Mexico after the Spanish conquest, and this name went with it. The name lucern, by which the plant is known in the Eastern States, comes from an old Italian word, and not from Lucerne, one of the Swiss cantons.

History.—Alfalfa has been cultivated as a forage plant for more than twenty centuries. It is a native of the central portion of western Asia, being yet found in a wild state there. It was introduced into Greece at the time of the Persian war, 470 B. C. It was cultivated by the Romans as a forage crop for the horses of their armies, and its growth in Italy has been continued down to the present time. It was probably introduced into Spain during the Moorish control, and was carried from there to Mexico and the west coast of South America. From Chile it was brought to California in the early history of this State, and has spread over the region between the Pacific Ocean and the Rocky Mountains and is now cultivated therein almost to the exclusion of other forage plants.

In the San Joaquin.—Attempts to obtain a better forage plant than alfalfa have ended in failure, or worse than failure, as witness Johnson grass, which was introduced as a substitute for alfalfa in this part of the State. The consequences of this attempt are familiar to all and need no comment. The length of time that the peoples of climates and soils similar to those of the San Joaquin Valley have cultivated this plant would seem to indicate that no better can be found for forage production; but if improvement is needed, it should be looked for not in plants of other species, but in the selection of seed to reach the end desired—either hardiness or greater productiveness. Every observing farmer has noted the differences of individual plants in the same field, and growing side by side. It is just as true of alfalfa as of any other plant, tree, or grain, that advantage could be taken of this to improve the stock by careful selection. In the writer's opinion it is as near perfect a forage plant as it is possible to obtain for this valley.

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*The writer wishes to acknowledge indebtedness to the bulletin on alfalfa issued by the Agricultural Department, Washington, D. C., for historical data and that portion of this paper in smaller type.

Growth.—Alfalfa is a deep feeder and sends its roots to a depth of ten or twelve feet if moisture is not sooner reached, provided the subsoil is permeable. It will grow in any favorable soil from sea level to 7,000 feet elevation. It grows best in sandy loams, such as comprise the bulk of the soils of this valley. It will not thrive in soils which contain an excess of iron. It feeds most heavily on lime, potash, magnesium, and phosphoric acid. Of these elements, lime is the most essential, and when it becomes exhausted in the soil the fact is shown in the decreased yield of alfalfa. Where surface irrigation is practiced, this condition is often reached by the lime being leached out by the abundance of irrigation water used, rather than by the plant taking it from the soil. As soon as the field shows the lack of lime by decreased yield, the remedy is gypsum, which is sulphate of lime, and is in the market at a reasonable price, being mined and brought from the mountain range bounding the valley on the west, where large quantities are known to exist.

Gypsum should be sown over the field during the winter so that the rains may dissolve and wash it into the soil. Do not use stable manure for alfalfa. It will stimulate the growth, but is worth too much for the peach orchard to waste in this way. Gypsum is better, and a person never having used it will be surprised at the results of the first application.

A Manure Plant.—From the preceding remarks it must not be understood that alfalfa is a crop that is exhausting to the soil. On the contrary, it is a soil-renovator or soil-builder. It belongs to that class of plants known as nitrogen gatherers, as the following extracts show:

> The legumes, to which family alfalfa and all the clovers belong, are able to draw nitrogen directly from the atmosphere. Other families of plants, for instance the true grasses, are unable to take up any nitrogen, except such as may be in soluble form in the soil. Hence alfalfa and its relatives are the best plants that can be grown by the farmer, for they manufacture large quantities of this most valuable and expensive fertilizing element.
>
> By raising alfalfa the farmer not only provides an excellent quality, as well as a large quantity of forage for his domestic animals, but he is at the same time enriching his fields, and doing it with a fertilizer which, if purchased in the market, would cost a great deal of money. When this crop is plowed under, or is fed to stock, and the manure returned to the land, it supplies a large quantity of nitrogen which is especially valuable for small grains, grasses, and root crops, and which the latter are unable to obtain for themselves.

Fruit After Alfalfa.—No better preparation for an orchard or vineyard can be made than to sow the land for a year or two in alfalfa. In addition to the nitrogen which is added to the soil, the roots open deep holes or channels from the surface to moisture, which the tree or vine roots at once follow down, which gives a deep-root system not so well attained in any other way. The percentage of nitrogen in the alfalfa plant varies considerably, being highest in the early stages of growth and least about the time seed commences to ripen. This indicates that hay should be cut not later than when the plant commences to bloom.

Irrigation.—Two methods of growing alfalfa are practiced. The general custom is to grade and check the land into squares previous to planting, and grow the crop by irrigation by flooding. This is the only method practicable on most farms, and wherever the subterranean water is not near enough to the surface to keep the soil above it moist to the surface. By this method alfalfa can be grown anywhere, and all waste corners and vacant pieces of land can be utilized as forage producers by the orchardist or vineyardist, it being by far the most valuable plant known for this purpose. It can be thus grown anywhere where land is farmed in Fresno County, except in a few locations near the Sierra foothills, where the soils are strongly impregnated with iron.

Underflow.—By the other method land is selected for an alfalfa field so located that the subterranean moisture reaches the surface or near thereto, and the seed is sown without any preparation of the surface other than plowing and harrowing. When a stand, as it is called, is obtained on land of this character, the resulting meadow is probably more productive than where surface flooding is resorted to in irrigating.

Water is applied by percolation, being run in wide, shallow ditches through the field upon the high ridges or parts. From these ditches it seeps or percolates through the soil and reaches all parts of the field.

A person purchasing land for the production of alfalfa alone should select this character of soil, where irrigation by percolation may be employed, as the first cost of preparing the land is less, the crop produced is larger and of better quality, and the field is longer lived than where surface flooding is necessary, especially if the flooded land is sandy and porous, as successive floodings gradually leach the lime, potash, etc., out of the soil. A moderate amount of alkali is no detriment.

Sowing Alfalfa.—Having made selection of the land and leveled and checked it (if it is to be flooded in irrigating), it should be plowed and thoroughly pulverized. The best condition of soil is obtained by growing an irrigated crop the season preceding the planting to alfalfa, such as Egyptian corn or pumpkins, and planting to alfalfa the following spring. If sown broadcast, twenty to twenty-five pounds of seed should be used per acre ; if drilled, fifteen or twenty pounds will do. If seed production only is aimed at, much less will do—in fact, is best—as the most seed is produced where the plants are thinly scattered over the ground.

For hay production a thick stand should be aimed at, as the hay will be finer, less woody, and more nutritious than when the stand is thin. The time of seeding varies with the locality; the season being October or November for fall sowing and February to April for spring sowing. The object is to sow when there is sufficient moisture to sprout the seed and bring the young plant to the third or fourth leaf before killing frosts occur. By far the greater amount of planting is done in the spring, and the writer favors February as the time in which to sow. This will give the young plant a good start in growth before the spring moisture is dried out of the ground, and it usually escapes being killed by frosts. Do not plant a nurse crop unless the land is prepared for flooding, and even then the utility of a nurse crop is very doubtful.

The writer has had best success in planting by sowing the seed upon the evenly plowed field without harrowing and then covering the seed with a brush drag. Delay irrigation until the young growth shades the ground, if possible, as the water packs the land and causes it to bake; and, when commenced, must be continually repeated throughout the entire season.

Alfalfa Hay.—The making of hay requires considerable skill to produce a first-class article, on account of the nature of the plant. If the hay is stacked or put in barn before the stems are cured, it is liable to heat and mould; and if allowed to get too dry, the leaves will all drop off and a large share of the best part of the forage will be lost. Cut when the field commences to bloom. If allowed to stand until in full bloom or after, the stems become stiff and woody and are not so fit for stock to eat. Cut in the forenoon and rake in the afternoon, and do most of the curing in the windrow and shock. Handle as much as possible in the morning when the hay is damp from the night air. It is best to stack in the field rather than to put at once in barn, as the hay can be put up greener without danger of heating. The art of making good hay is to be acquired by practice and observation rather than by following directions. The result to be aimed at is to stack it when it is just sufficiently cured to keep without heating, and yet green enough for the leaves not to drop off.

Crop.—The number of cuttings in this county are from four to six per season. During the heated season with plenty of moisture a crop will be ready to cut every four or five weeks. When grown for seed, the second crop is the one usually saved for this purpose. The first crop does not seed so well. The yield is variable from year to year. Probably three hundred to six hundred pounds to the acre is the average. The seed weighs sixty pounds to the bushel.

Pure Seed.—In buying seed, look out for weed seed, especially Johnson grass. This seed is easily seen, as it is very much larger than alfalfa and of a shining black color, long in shape, while alfalfa is yellow. Seed often contains a small, round, shining black seed which is smaller than alfalfa. This is a celosia or tumble-weed seed, and is harmless, except as its weight adds to the cost of the seed. The continuous mowing of alfalfa kills out this and all annual weeds and most perennials—indeed, Johnson grass is the worst thing to be feared. Pastures should be mowed at least twice a year to kill out weeds left by stock.

Value of Alfalfa Hay.—Alfalfa hay is worth as much, weight for weight, as any other hay, and is eaten by all farm stock. Horses when first given this hay may take some little time to acquire a taste for it, but will not refuse it long. It is not in itself a complete ration, however. It is rich in protein—that is, in the albuminoids which, when fed to stock, produce blood, muscle, tendon, and bone. It is poor in fat, sugar, starch, etc., or technically, carbohydrates. To complete the ration when alfalfa is fed, something must be fed that contains large amounts of the latter substances to balance the protein of the alfalfa, or the excess of the latter will not be digested. Such feeds as wheat hay or straw, sorghum, cornstalks, and root crops are all rich in carbohydrates and poor in protein, and together with alfalfa in right proportion make a perfect ration. Alfalfa hay is especially valuable to young and growing horses, cattle, and sheep, as they require a food furnishing large quantities of flesh-forming material. For work horses feed a small grain ration—barley or, better, Egyptian corn.

Bloating.—Where cattle or sheep are pastured on growing alfalfa, care is necessary to prevent hoven or bloat during cold, rainy days of spring and fall. The chance of loss from this cause is much lessened if a stack of straw or cornstalks is kept where the stock have access to it, also salt where it can always be reached by the stock is beneficial. Horses and hogs are not affected by bloat, but horses will thrive much better on the pasture with straw than without on much better pasture. Soiling—that is, cutting and feeding the cut alfalfa green—is practiced in older countries, but has not been practiced here to any extent.

For Hogs.—Alfalfa is the principal summer forage for hogs, which are extensively grown to utilize the waste on the raisin vineyards in the fall after the raisins are harvested. To get best results, the field should be divided into lots of such size that the band of hogs kept will eat off a lot in a week's time or less, when another lot is thrown open to them and the first lot closed and allowed to grow again. It should be fed off before it commences to bloom, as it then contains the most succulent food. This method gives each lot in turn a rest and a chance to grow again and will provide more forage of a better quality than where a field is continuously pastured during the summer.

When to Irrigate.—Where alfalfa is irrigated by flooding, one crop a year can be gained by flooding just before hay is cut rather than by waiting until hay is taken from the field; also there is less danger in scalding when field is shaded by the standing crop. Do not let the water stand on it over twenty-four hours. Arrange irrigation so you can shut water off in the evening rather than in the morning, so that it can soak away during the cool night and not get so warm as it will if left to soak away in sunlight. While fresh water is running from the ditch, it keeps the plant cool; it is when shut off that scalding is most likely to occur.

Enemies.—The principal enemies of alfalfa are foxtail grass, dodder, and gophers and squirrels. Foxtail is not such an unmitigated nuisance if mowed early, as it makes a good hay for loose stock. Where the ground is moist enough to cause the grass to grow after the first cutting, the only remedy is to mow early and burn the crop without raking, which kills the grass without seemingly injuring the alfalfa. Dodder is not troublesome in this vicinity. Where patches occur in fields, it can be killed by scattering a layer of straw over and burning. Where dodder is a serious pest, it is best to screen all seed sown, as dodder seed is smaller than alfalfa and can be removed by a screen that will let it pass through and retain the alfalfa seed. Gophers and squirrels are the worst pests the Fresno farmer has to deal with. Poison or drowning by flooding are the only remedies. Smothering with bisulphide of carbon is very successful when the ground is wet.

Conclusion.—In conclusion: Do not sow alfalfa in your orchard; it will kill or render it worthless. Do not plant every new perennial you see advertised in hope of getting something better than alfalfa. Twenty centuries' experience says it cannot be done. Remember the Johnson grass experience!

Put one of the several good horse carrier forks in your barn and another in your field on a stacking frame to save time and labor in handling the large amount of forage you raise.

ALFALFA AS A DAIRY CROP.

By C. H. SESSIONS, of Los Angeles.

In keeping cows for milk it is necessary for the dairyman to use the greatest precautions in the selection of feed, in order that he may reduce its expense to a minimum, and raise its value to a maximum.

The hay feed is of great importance, as its quality may require quantities of grain to obtain a properly balanced ration, which is necessary to get the best results.

In the East dairy authorities urge the feeding of more clover to get all the nitrogen or protein possible, and then they have to feed considerable grain.

In Southern California the price of grain is so high as to make the feeding of it quite a burden, and if we can find any cheaper feed that will answer nearly as well we should do so, even if the results are not quite so good.

In alfalfa we have such a food, containing nearly twice the protein of clover and a little more carbohydrates and fat.

The following are the analyses: Clover hay, by Woll, 6.5 protein, 34.9 carbohydrates, and 1.6 fat. Alfalfa hay, by Jaffa, 12.2 protein, 36.2 carbohydrates, and 1.7 fat.

A very good combination can be made by feeding alfalfa with the grain hays, green or dry corn fodder, corn ensilage, beets and pumpkins, and without buying grain.

Chemists tell us that a balanced ration for a 1000-pound cow should consist of 24 pounds of organic matter, 2½ pounds of protein, 12½ pounds of carbohydrates, and 4 pounds of fat, or a ratio of 1:5.4.

In alfalfa hay, according to Jaffa, we have a ratio of 1:3.3, or with an excess of protein, which is an advantage, as it takes the place of bran, oil-cake meal, and cotton-seed meal. To bring the ratio up to the standard, we can feed any of the other foods mentioned which may be in season and the cheapest to obtain.

At present we are feeding 20 pounds of alfalfa hay, 4 pounds of oat hay, and 30 pounds of green corn fodder, with good results. This makes a ratio of 1:4.6. This gives us an excess of protein, but as it is produced with cheap feeds it may be cheaper than to try to balance it with more concentrated food, such as corn meal or barley. We have fed all the feeds in combinations of two or three varieties at a time with far more profit than by buying and feeding grain. We sometimes feed corn when it can be had at a reasonable price. We grind corn and cob together, which, with alfalfa, gives the best of results.

Some of our dairymen feed alfalfa and bran, and claim good results, but I think that if the same money was paid for corn, or feed meal instead of bran, they would get still better results.

Alfalfa hay and bran produce an excess of protein, and although that excess is converted into carbohydrates, it is done at a greater expense than by feeding carbonaceous foods. It will not require so much food to produce the necessary carbohydrates.

Milk produced by alfalfa hay is of the best quality, being well up in solids and butter fats.

Green alfalfa, either pastured or fed in an uncured state, while making a good milk, gives it an objectionable flavor which most people dislike. Alfalfa which is dry enough to go into the barn, imparts such a flavor, and we have found that the only safe way to feed it without trouble is to put it in the barn and let it pass through the sweat, when it can be fed freely.

In the winter when the ground is not wet we sometimes pasture our cows a short time each day on the winter growth, which would be killed by the frosts if left; but the flavors in the milk must be watched and the time lengthened or shortened as the necessities require. A little carelessness on the part of the herder in leaving the cows out too long will cause an endless number of complaints from customers. These flavors show themselves in butter and cheese, but not so noticeably in the former as in the latter.

For the best quality of cow hay, alfalfa should be cut just before blooming. As soon as a single blossom is seen the mower should be started, and if the field is of good size the blossoms will be quite thick before the field is finished.

In Stewart's "Feeding Animals," I find that hay cut before head has a ratio of 1:1.6; when cut before bloom, 1:2.6; when cut in bloom, 1:3.7. As the dairyman is after all the protein he can get, he will find it in early cut hay. As the leaves contain the most of the protein it is necessary to use caution in curing the hay to save these.

In our climate we have used very successfully a hay tedder. The mowing machine is run until ten o'clock and then the team is put on the tedder, which turns up what has been cut. The alfalfa is then left loose and standing up where the wind can blow through it, drying it evenly. When left on the ground to dry it lies thick and close like a blanket, and the surface gets so dry as to make the leaves crisp, while the underside is still damp. As soon as the hay is dried through evenly it should be raked, put into good-size cocks and let stand until a sweat has taken place and the whole is tough and pliable so that none will be lost in handling.

Alfalfa makes an excellent pasture for hogs, and it is claimed that one acre will grow one thousand pounds of pork. We have not tested this, but in pasturing it the hogs must be ringed if it is at all overstocked, or they will dig out every root. They will dig a hole so deep as to go out of sight. It is good exercise for the growing pig, but hard on the alfalfa.

It may not be out of place to tell how we cultivate alfalfa.

The ground should not be plowed too deeply, but the surface should be left fine and smooth. Several harrowings before seeding are necessary to get the surface in condition. If the soil has any alkali it should be plowed in narrow lands, high in the center, so as to drain to the dead furrows. In the rainy reason this washes the alkali to the dead furrows, where it can run off to drainage ditches and so give the alfalfa a chance to grow without being affected by the alkali crystals.

There is a great variety of opinion as to best time of seeding. We have sown at all times, from November or December to April, and have had good and poor success; it depends on the season, and nothing can be told of them beforehand.

I think it best to sow early, say after a good rain, as soon as the ground has become dry enough to work easily, and then, if from frosts or scant early rains the stand is a failure, there is plenty of time to prepare the ground and put in another crop, hoping there will be plenty of late rains to give it a start. There is no danger from frosts after the third leaves have started.

Some claim that ten to fifteen pounds of seed to the acre is sufficient, but we prefer twenty-five to thirty pounds. If it all grew the small amount would be all right, but conditions are so liable to prevent all from growing that I prefer to pay a little more money for seed and insure a good stand.

If the stand is thin it is not the easiest thing to thicken it up successfully, but if the seed comes up too thick it is a "survival of the fittest" and the weaker stalks are killed out, leaving a good, thick and even stand, which makes the best quality of hay.

For a nurse crop in starting alfalfa nothing is better than a very light crop of wheat, say fifty pounds of seed per acre. If a greater amount of seed is used the wheat will come up so thick as to smother the alfalfa, or if it grows it will be so tender that as soon as the wheat is cut it will wither and die. If the wheat should be too thick, it must not be left until grown enough for hay, but cut and removed earlier.

Some prefer nothing but weeds for protection, but it will cost no more to grow a light crop of wheat, and what is taken off will be good feed, while the weeds will have to be thrown away.

When a stand from any cause gets thin and needs thickening up, one of our neighbors recommends that the ground be harrowed or disked so as to loosen the earth, and seed sowed before the rains begin. He says he has been successful in this, where before he had found it hard to re-seed an old stand.

We top-dress our alfalfa stands with fine manure from our corrals in the fall before the rains and then run a disk over it both ways. The disk may cut and split some of the heads of roots, but the damage amounts to nothing.

Some think top-dressing is not necessary, but we think it does the soil good and leaves a mulch to hold the moisture.

On our farm in average years we can cut six or seven crops of hay without irrigation, but there is no doubt that the yield can be increased by irrigating. The question of expense comes in here and the farmer must decide whether it will pay him for his trouble or not.

There is considerable difficulty in curing the first and last cuttings to make good hay, and some recommend that these cuttings be put in the silo.

ALFALFA-GROWING IN CALIFORNIA.

By REV. B. EDMISTON, of Riverside.

Our Greatest Product of the Future.—Were I called upon to express an opinion as to what single product of the soil would probably assume the greatest importance in our State within the next century, I should not hesitate to say alfalfa. As a forage plant for general use, as far as I know, it has no equal in value. This may be said not only in regard to its enormous productiveness, but as well in regard to its excellence as a feed, particularly for horses and cattle. For teams doing ordinary work on the farm, and for milch cows, it answers the purpose of both hay and grain. I feed no grain to my teams, and they not only stand work well, but they keep in good condition and in good flesh.

With our almost perpetual summer and with soil specially adapted to its growth, who can estimate the extent to which its production may be pushed in almost every part of our State? And who in imagination can look forward to the middle of the twentieth century and contemplate the vast number of profitable dairies, the fat beef cattle and fine horses raised on alfalfa, either in pastures or after made into hay, without pleasure and gratitude to the Bountiful Giver of so rich a heritage?

Requirements.—But I am reminded that alfalfa can be successfully grown only where water for irrigation is abundant. However, there are occasional tracts of moist land where it does fairly well, though its cultivation on such land is attended with difficulties unknown on land which must be irrigated. The busy gopher works three hundred and sixty-five days in the year. And there are grasses, particularly Bermuda grass, which spread on such land with great rapidity and in a few years destroy the alfalfa. In making such large claims as to the extent and importance which alfalfa culture is destined to assume in the near future, I am met by the objection that the scarcity of water will for all time be an insuperable difficulty in the way. It is true that in many places water can only be obtained at great cost of capital and labor. Nevertheless, we cannot doubt but that there are millions of acres of choice lands suitable for the purpose now lying waste which will be provided with water long before the middle of the twentieth century. It is only a question of capital and labor collecting and saving the enormous precipitation in our mountain districts. The rich valleys and plains extending from the southeast to the northwest in an unbroken chain for eight hundred miles were not planned by the Great Architect to remain forever waste. Whoever thinks so has studied the greatness of our State to little purpose.

Suitable Land.—In Southern California alfalfa will do fairly well on almost any land suitable for grain growing or orchard purposes where water can be secured in abundance for irrigation. And as a rule every farmer and orchardist who has such land will find it to his interests to grow a sufficiency for his teams and a cow or two. But it should be understood that there is a great difference in the adaptability of land, even in the same neighborhood, to alfalfa-growing. And one who has chosen this industry as a prominent branch of his business should carefully select his location, as success or failure may hinge on the choice made. A porous subsoil which will take water freely can scarcely fail to give large crops if properly irrigated. There is ample fertility in almost any of our mesa lands to produce well if the roots can freely penetrate the subsoil. But there are tracts of land with fine surface soil which cannot be made to produce heavy crops, simply because neither the water nor the roots can penetrate the underlying hardpan or tough clay subsoil. I have had some unpleasant experience in this direction, against which I would guard the inexperienced. In selecting land for this purpose one should not take surface appearances. He should dig down and find out what is under the surface, else he may be deceived.

Preparing the Land.—Burn or remove all weeds and rubbish before plowing. If there are small mounds or hillocks which need to be removed with the scraper, it is much easier to do it before plowing the whole surface, as the low places, where the dirt should be dumped, may then be readily seen. And whatever leveling is needed should be done with reference to the location of the irrigating ditches. It is very important that the general lay of the land be accurately ascertained, either by a competent engineer or by the actual running of water.

After the ground has been leveled as thoroughly as possible with the scraper, it should be well plowed and the surface carefully pulverized. All dead furrows should be filled and some suitable instrument used to make the surface level and smooth. A piece of square timber, twenty-five or thirty feet long, weighted down so as to make a load for two teams, one hitched at each end, and drawing it sidewise over the land, will level the surface as well or better than any other contrivance I have seen at work. And, as this is done rapidly, it is well to go over the land two or three times, changing the direction each time. This will put the ground in fine shape for irrigating, if the general level has been secured, and it will somewhat pack the loose ground and thus prevent the young alfalfa plants from drying out if the north wind should blow, and enable the roots more readily to fasten in the soil.

Laying Off for Irrigation.—For convenience and economy in irrigating, a ten-acre lot should be divided into three or four equal blocks. I have had considerable experience with five-acre blocks (twenty by forty rods); but I have always found them too wide for the equal and easy distribution of water. The water would stand over parts of the block longer than necessary before it could be forced over other parts. Consequently, the water is not equally distributed, some parts receiving more than is necessary and other parts not receiving enough.

Amount of Seed Required.—The amount of seed sown is not a matter of so great importance as the manner of sowing and covering. Nothing heavier than a horse rake, lightly run over the ground, should be used. A brush, or a considerable bunch of brush, fastened together, answers the purpose well. All that is wanted is to imbed the seed somewhat in the fine dirt on the immediate surface. It does not matter much if much of the seed remains in sight. Indeed, if the sowing is followed by a heavy rain or by flooding the ground, so as to insure a moist surface for four or five days, it is all right without any covering at all. Two years ago I sowed a block, and when about half of it was lightly covered a heavy rain drove us in. I never had a finer stand, the uncovered part being just as good as that which had been covered.

Thus treated, ten pounds to the acre will make a very thick stand—even more than is needed. I once sowed ten pounds to the acre on one-half a ten-acre tract and seven pounds per acre on the other half; and after it came up no one could have told the difference. It was all abundantly thick. Then, if you cover very lightly as above, or see that the ground is wet by rain or by flooding, ten pounds of seed per acre is the greatest plenty. But if one insists on covering with a heavy harrow, or an ordinary cultivator, as grain is covered, a heavy investment in seed will be required, as a very small part of the seed sown will ever send a plant to the surface.

Cutting and Irrigating.—After sowing and seeing that the ground is properly wet, nothing further will be required until the ground needs irrigation. But when the alfalfa gets six or eight inches high it should be mowed. This will check the weeds and cause the alfalfa to branch and to grow with much greater vigor than if left uncut.

Through the first season the ground should have a good flooding after each cutting, and oftener if needed. It will grow all the faster if flooded once in every three or four weeks. If sown in the winter or early spring, the first season ought to make three or four tons per acre, if properly cared for. However, the first season's crop will vary greatly on different soils—much more than in following years.

Making Hay.—It is well to begin cutting quite early in the spring, especially if one has a good deal to cut, but no definite date can be given, as the seasons vary greatly. It is a mistake to wait for the alfalfa to become large and show signs of blossoming. By cutting the early growth about the time the warm spring days begin to come, though it may make only a light crop, the new growth will start with vigor, and at the end of a month, when ready to cut again, you will probably have a ton per acre more than if the two cuttings had been thrown into one, and the hay will be of much better quality.

There is another important advantage in early cutting. Foxtail grass often spoils the first cutting of hay for horses. But if cut before the grass head begins to harden it is entirely harmless, as it will not fasten in a horse's mouth at this stage.

Condition at Cutting.—Throughout the season great care should be taken to cut promptly when the alfalfa has reached a proper state for making first-class hay. Of course, there are different opinions as to what the "proper state" is. I can only give my own opinion and the reason for it. And that opinion is that it should be cut before the stalk begins to harden, as it always does as the buds mature and the blossoms begin to open. If it stands longer, the quality of the hay deteriorates much more than the additional growth can compensate for. But there are those who want it to stand longer. They say that it makes better feed and has more substance in it. This is true, if woody substance is desired, but it is not true if nutriment is the object in view, if we may rely upon the tables and statements made in Farmers' Bulletin No. 31 of the United States Department of Agriculture. On page 18 it is said: "The percentage of nitrogenous compounds in the plant varies considerably, the maximum being in the early stages of its growth and the minimum about the time the seed commences to ripen. Hence, hay cut early, especially before the plant begins to bloom, is more nutritious than that cut after it has begun to bloom." The writer gives the analyses of hay made at four different periods in the growth of the plant, showing that the statements just made are correct from a scientific point of view. And I feel sure that experience will lead any careful observer to the same conclusions.

Local Experiments.—About two months ago, after feeding my cow for some time on hay which had been cut when in bloom, I changed to hay cut before it began to bloom, and at once her flow of milk increased at least one fourth. And my neighbor, Mr. H. D. Noland, tells me that in the same way the weight of milk given by his herd has been very greatly increased just as soon as changed from hay made in the ordinary way to that made from tender, young alfalfa.

Another point in favor of early cutting is worth considering. Cows will then eat the stalks clean, wasting nothing. But if it stands until in bloom, when the stalks become woody, they cannot be induced to eat them, often wasting one fourth of the weight.

Hence, I am fully convinced that one making hay for his own use will find it decidedly to his advantage to cut before stalks begin to harden. And in making hay for sale it will be just as much advantage to his customers, and will be better all around, if they can be induced to pay a little more for such hay to make up for the loss in weight in cutting before it is fully grown.

Suggestions.—I would never cut at one time more than can be raked and put in cocks in the forenoon of the next day, if it is in the hot and dry summer months, or in the forenoon of the first day after it is sufficiently cured. However, the very early or very late cuttings, when the only difficulty is to get it dry enough to keep, may be handled in the afternoon without breaking the leaves and losing them. But through much of the season alfalfa hay should never be touched in the afternoon, or after the leaves begin to break.

One should never cut and put in the cock forty or fifty acres, as I have often seen done, before beginning to haul it in. Hay thus treated is scarcely worth more than half price, to say nothing of the delay of one week, or perhaps even two weeks, in irrigation which this method requires. One cannot afford this loss. When I have sixty or seventy acres to handle, I generally cut about five acres in the morning and put in the cock the same amount cut before, and come as near as I can to hauling the hay from five acres each day. But I generally find it necessary to stop cutting a day or two each week to catch up with the hauling. When the weather is very dry and hot we think it pays to go to the field as soon as it is light, and lay off for the remainder of the day when the hay becomes too dry.

We find it a great convenience and economy of time and labor to have large and convenient racks on our hay wagons. We use flat racks, eight by sixteen feet. On one of these we can, without high pitching, conveniently put on a load of two tons, and without any danger of its slipping off on sloping ground. A two-ton load on such a rack is about twelve feet wide and eighteen feet long, and no higher than a ton load on the kind of racks I often see used. And the average team can haul two tons on our hard roads easily, and it saves much time when one is hauling three or four miles.

ANIMAL AND DAIRY INDUSTRIES IN CALIFORNIA.

By LEROY ANDERSON,

Instructor in Animal and Dairy Husbandry, University of California.

Modern history has shown that, as the State becomes older, its resources better known and more thoroughly exploited, greater and greater attention is paid by the Government to the primitive and yet foundation industry of agriculture. The testimony of European countries is that the best development of the nation and the enlightenment of its people demand a thorough study, by trained men under Government employ, of all the sciences which so intricately entwine all the functions of plant and animal growth and upon which rests the true agriculture of to-day. Every State in the Union, and the National Government itself, bear similar testimony to the importance of agricultural education in the establishment of agricultural colleges and experiment stations all over our broad land. When the soil in its virgin condition returns rich harvests by only the shallowest kind of cultivation, there is little call from the farmer for knowledge concerning his business. But when the soil refuses to respond handsomely to such treatment; when mining the soil, as it were, ceases to be profitable, then the farmer looks about for the scientist to tell him what to do, and the State responds to his needs. Or, in growing fruit or producing the various meat and dairy products, so long as the supply is sufficiently short of the demand to insure a large margin of profit, there is little incentive to a careful study of the business tending toward improvement in production. Let the market become overstocked, however, and prices go so low as to cut off the usual easy profit, then there is a battle for the "survival of the fittest," and a call for some one to tell how to decrease the cost of production so as to insure a living profit.

The State of California was one of the first to appreciate the needs of agriculture by establishing an Experiment Station and College of Agriculture, and all who are familiar with the work of this institution testify to its inestimable value to the development of the State as well as to the multitude of individual citizens who have been directly benefited by its services. California has as varied a condition of soil, climate, and production as all the rest of the United States combined; the demands, therefore, upon the Experiment Station have been most peculiar and extensive. That these demands have been well met is attested by the vast knowledge which is now possessed concerning the various soils of our State and their relation to plant growth; and also by the incalculable benefits extended to the horticultural and viticultural interests.

The College of Agriculture is now to turn added attention to the animal and dairy industries, and a glance at their importance and needs is quite in keeping with the present undertaking. The money value of the various products of the dairies of the State for the past two years is given in the last report of the State Dairy Bureau. These values include those of calves and pigs raised on the by-products of the dairies, creameries, and cheese factories, as given in the table below. The figures are for the years ending with October 1, 1899, and October 1, 1900:

1899-1900.

Butter	24,869,084 lbs.	$5,392,020
Cheese	5,294,938 lbs.	593,033
Condensed milk	52,558 cases	218,988
Milk and cream consumed		5,325,399
Calves raised from dairy cows		783,423
Pigs raised on by-products		964,762
		$13,277,625

1899-1900.

Butter	28,782,859 lbs.	$6,360,054
Cheese	4,989,960 lbs.	503,986
Condensed milk	66,302 cases	276,258
Milk and cream consumed		5,567,462
Calves raised from dairy cows		1,293,276
Pigs raised on by-products		1,492,236
		$15,493,272

This valuation places the dairy industry upon an equal footing with the other important industries of the State and gives some indication of the large amount of capital which must be invested in the business. No such statistics have been compiled as to the value of the various animal products—beef, mutton, pork, poultry, and eggs. The indications are, however, that the State's production in these latter lines does not so nearly reach the amount of home consumption as is the case with butter. Some figures showing our importations of the various animal and dairy products will doubtless be of interest and value. Through the courtesy of the Traffic Managers of the Southern Pacific and the Atchison, Topeka & Santa Fé Railroads and the Pacific Coast Steamship Company, the writer has been able to secure the amounts of these products which are brought into California by the different lines of transportation. Since these companies carry practically all such products that come within our borders the figures given may be considered to cover nearly all importations of the commodities named. Through the courtesy of the Custom-House officials has also been secured the quantities of the same products exported from the port of San Francisco for like periods for which importations are given. These figures are all for the two fiscal years ending June 30, 1899, and June 30, 1900, and are given in the table below.

For the sake of the reader's convenience the total importation of the three transportation companies is given in each case, except with live animals, where a division is made owing to the fact of the Southern Pacific Company's returning no statistics for sheep.

POUNDS OF ANIMAL AND DAIRY PRODUCTS

Imported into the State of California, and Exports of Same, for the Fiscal Years Ending June 30, 1899, and June 30, 1900.

	1899.	1900.
BUTTER—		
Imports	1,903,980	2,978,600
Exports	452,857	624,714
	1,551,123	2,353,886
CHEESE—		
Imports	3,999,770	3,513,500
Exports	586,481	570,558
	3,413,289	2,942,942
CONDENSED MILK—		
Imports	5,078,000	5,294,000
Exports	980,000	1,240,000
	4,098,000	4,054,000
POULTRY—		
Imports	8,924,300	5,192,400
Exports	39,420	43,990
	8,884,880	5,148,410
EGGS—		
Imports	9,599,000	8,510,400
Exports	39,100	73,930
	9,559,900	8,436,470
CATTLE, SHEEP, AND HOGS—		
Imports—Cattle (S. P.)	1,000,000	1,000,000
Hogs (S. P.)	16,000,000	4,500,000
Cattle, sheep, and hogs (Santa Fé)	6,027,600	21,062,600
	23,027,600	26,562,600
Exports—Cattle, sheep, and hogs	1,141,100	497,000
	21,886,500	26,065,600
PACKING-HOUSE PRODUCTS—		
Imports	61,386,600	57,246,200
Exports—		
Beef—Fresh	170,954	593,168
Canned	1,111,610	1,297,520
Salted or pickled	736,100	1,064,200
Pork—Salted or pickled	137,580	144,750
Bacon	335.203	347,260
Hams	726,769	901,699
	3,218,216	4,348,597
Tallow	3,544,693	1,608,768
Lard	978,057	793,160
Total exports	7,740,966	6,750,525

It is not to be supposed that the amount of exports here given covers all of these products which pass out from California ports. Since the acquisition of the Hawaiian and Philippine Islands no goods going to those places are classed as exports. The figures, therefore, do not include any commodities shipped to the islands since they became American territory, nor any shipped to Alaska. If such goods were included there would not remain so large a differential between imports and exports for the State. The principal point at issue, however, remains the same, viz: whether we consume all the products which come within our borders, or whether we suffer them to be shipped again from our ports, that present market conditions warrant us in trying to secure a large increase in production from our farms, flocks, and herds.

Comparison between home production and importation of dairy products indicates that in butter alone do we produce anywhere near enough for home consumption. The importation of butter is about 10 per cent of the total local production. In the case of cheese we import about 70 per cent as much as we produce, and of condensed milk we import over 300 per cent more than we produce. It is to be regretted that statistics are not available showing the ratio of importation to production in the other commodities named. The figures given, however, indicate that a large profitable growth is possible in poultry, eggs, and the various meat products.

The extent to which a foreign market may be developed for dairy products in the Orient is still more or less a mystery. Aside from what may be opened among Japanese and Chinese markets it would seem that a considerable increase in trade might be expected with the Islands, Alaska, and Central and South American States. California stands at the gate leading to all these lands, and with her broad fertile areas is able to supply all that they can demand. Some work has been done by the National Government looking toward a development of the butter market in the Orient, and doubtless more would be done did we urge the subject upon the authorities having the matter in charge. It is possible that much could be accomplished by a coöperation of the various dairy interests to establish a good market in the more nearly contiguous countries above named. If such a step were attempted the principle of sending nothing but the best products should be firmly established and strictly adhered to, for it is only by living closely to such principles that we may hope to retain or even secure any portion of foreign trade.

Other features of the market for our dairy products should not escape our attention, and they carry a considerable source of encouragement. The present population of California of one and one half millions is bound to increase rapidly during the coming year, and a consequent increase in home consumption of all edibles will therefore follow. Again, some of our most enterprising dairymen are expecting to place some of our surplus butter in Eastern markets. This proposition doubtless seems ridiculous to the Eastern man; but when it is taken into consideration that by reason of our milder and more equable climate the cost of caring for cattle is less, and by reason of our ability to raise the best of feeds cheaper the cost of producing a pound of butter fat is less than in the East, the proposition assumes a state of gravity to the Eastern dairymen and of vital interest to us. Another important consideration to be borne in mind by the producer is that there is far less danger of flooding the market with goods of extra quality than with goods of inferior quality. In fact, the consumption per capita of butter and cheese shows a large increase when the best grades are readily obtained. Altogether the outlook is bright for the dairymen who are endeavoring to place upon the market only first-class products.

EXTENT AND CONDITION OF DAIRYING.

Dairying is confined to no section of California. It extends from Siskiyou to San Diego. At the same time there are portions of the State which appear, or have appeared, more naturally adapted to its pursuit than others. The most notable example of natural environment is the Eel River Valley in Humboldt County, where green pasturage may be had the whole year through. In this section the grade dairy cow has reached a better development and a higher degree of production than elsewhere in the State. The cow has transformed a condition of bankruptcy in trying to raise and sell grain and potatoes to one of plenty and independence by selling butter instead.

Other coast regions all the way down to Santa Barbara have been considered the naturally endowed dairy precincts of California and a fair measure of success has been secured therein. But through poor management of the pastures and a lack of knowledge of supplemental forage crops the margin of profit has been decreasing. The coast sections, under their present management, require so many acres of land per cow that it is doubtful if they can continue dairying at a good profit when brought into close and strong competition with sections where less land is needed per cow and where more scientific methods prevail. The use of the silo in conserving both forage crops and pasturage will do much to help the coast dairymen in the keen competition which is quite sure to come within a few years. By the help of the silo the annual yield of milk and butter per head may be doubled and an increase of fully fifty per cent more animals kept on the same acreage. The cost of producing a quart of milk or a pound of butter fat is accordingly reduced and a greater opportunity offered for a margin of profit.

The large interior valleys present a field for operations in dairying which is most magnificent to behold. The best of cattle foods, viz:

alfalfa and Indian corn, can be grown in abundance, and there appears no limit to the amount of milk that may be produced on the vast areas. These regions were formerly thought too hot to produce good butter and cheese, but they are now turning out the best product simply because the people are obliged to use the most modern and scientific methods in order to do anything at all. The indispensable accompaniment of good butter and cheese is a proper control of temperatures. The section, then, which is so hot as to make ice plants essential will, other things being equal, turn out a better product than the region where an ice plant is not generally considered a necessity.

There is not an arable section in the State where dairying cannot be successfully carried on. There is not a tillable section where sufficient and proper feeds cannot be grown for vast numbers of cattle and other domestic animals as well. Former and present success in the business is leading many to enter the field for the first time and many others to enlarge their herds. The success of dairying in the East leads us to believe in its success here, whether entered upon as a specialty or in connection with other lines of agriculture. As a side issue for growers of fruit it brings increased profits, not alone from the actual milk, butter, and cheese sold, but through the possession of quantities of material providing the humus and fertility which are an absolute necessity in all of our orchards. Much of the land now given to unprofitable grain-growing could be greatly enriched and made profitable by turning it to dairying. Thoughtful men are looking eagerly forward to the day when our great wheat ranches may be broken up into small farms and become the homes of a thrifty and industrious population who till their own soil and surround themselves with the comforts of life coming from well-kept herds, orchards, and vineyards.

WHERE IMPROVEMENT IS MOST NEEDED.

The most striking features of California dairying which stand out prominently as needing improvement are along the lines of breeding and feeding the stock. Taking the State as a whole, there is far too little thoughtful attention put upon these factors in successful dairy husbandry, and as a consequence the returns from the herds are in no wise commensurate with the number of animals kept. It must be conceded that the rapid increase in the number of men who desire to go into dairying has made it difficult to buy what cows are wanted without considering quality. Importing thoroughbred or high-grade animals from the East is too expensive for most farmers to indulge in, and thus a cow is a cow when the dairy is established. Although these facts stare us in the face, it is still very apparent that our dairy cattle are not what they might have been had a careful system of breeding been followed.

We do not need to possess all thoroughbred stock in order to appreciate the true value of such animals. Neither do we need to have our herds entirely composed of thoroughbreds in order to reach a stage of highly profitable production. What is necessary is to realize the value of the thoroughbred sire in improving the ordinary grade herds, and to use none but thoroughbred sires for breeding purposes. The merit of the thoroughbred animal lies in its being the descendant through a long line of ancestry which has been selected, bred, and fed continually with the idea of producing animals best suited for the particular purpose for which the breed is designed, whether that purpose be to make meat or milk. The best known breeds of cattle have been developed through one hundred or more years of this kind of breeding, and their breed characteristics are, therefore, very firmly fixed. When a thoroughbred is bred to the ordinary native animal of no particular breed, or of a mongrel mixture of breeds, the traits of the thoroughbred will be more strongly implanted in the offspring than the traits of the mongrel. This principle and fact enable the dairyman to improve his herd at a small expense by the purchase of a thoroughbred bull to head his herd. Before buying the bull the breed which it is desired to grade up to should be decided upon. Then stick to that breed, and use none but thoroughbred bulls of a good strain backed by as many good records as possible.

In order to know which are the best cows in the herd from which to choose heifers for the future generations, some kind of a careful record must be kept of each cow's yield of milk and butter fat. An approximate record, near enough for practical purposes, may be obtained by weighing the milk from each cow twice a month and testing a sample of the weighed milk for fat by the Babcock test. Because of the variation in per cent of fat between night's and morning's milk, it is best to weigh both milkings for the day and take an equal amount of each to be mixed for the Babcock test. By this simple means the dairyman may easily calculate the yield of milk and butter for each cow of his herd every year. He will soon possess a speaking acquaintance with all the cows and find out that some are eating up the profits which others are making for him. Having obtained this knowledge he will not be slow in weeding out all unprofitable animals. No better foundation for a high-grade herd can be found than exists in nearly all parts of the State in the large numbers of grade Shorthorn cows. They are excellent animals on which to breed the special purpose Jersey or Holstein-Friesian, and also the dual purpose Shorthorn if bulls from the dairy strain can be secured.

The science and art of feeding is the other line along which an improvement may confidently be expected to bring increased profits, for no matter how well we select and breed, improvement will be sadly lacking without due attention to the kinds and amounts of food given the animals. A study of the balanced ration for milk production should be carried on by every one who feeds a cow in order that he may know how to mix the various foods at his command to bring the best results. The cow needs to be fed a balanced ration in order that she may give the largest amount of milk of which she is capable and still keep her health and not lose in flesh. Aside from having the ration contain the right proportion of protein, carbohydrates, and fat, due attention should be paid to variety for the sake of the cow's appetite, and to succulence for the sake of palatability and ease of digestion. Succulence may be supplied, when pastures are dry, by roots of various sorts, sugar beet pulp, soiling crops, and best and cheapest of all, by the use of the silo in conserving food in its green and palatable state. Universal study and attention on the part of all dairymen along these two lines of breeding and feeding would in ten years increase the average yearly production of California cows from 150 pounds of butter to the 300-pound mark, which is now held by the cows of Humboldt.

When we look at the manufacturing side of the dairy business, i. e. butter-making, we find a very encouraging state of affairs. Creameries in California are generally as well if not better equipped than in the older dairy sections of the East. The most modern appliances are here more common; the refrigerating plant is oftener met with; and methods for making print butter are more expeditious. Possibly the mechanical side of butter-making has gone ahead of the intellectual, which could be accounted for by reason of creameries being started faster than men could be trained to manage them. This training has to be supplied in the factory, with little opportunity for studying the principles underlying butter-making, and while men may and do become good butter-makers in this way, they would undoubtedly do better and enjoy life more had they the opportunity to take such a course of study as is given in the modern dairy school.

The cheese problem is one that demands immediate attention, for the good work spoken for butter-making above cannot be applied to cheese-making in California. While our full cream cheese has dropped 1½ or 2 cents per pound in the San Francisco market, Eastern Cheddar continues at the same high mark of 15 to 16½ cents. Although only a few months on California soil I feel confident that we can make as good cheese of any variety as can be made in the East, and if well-cured Cheddars are to continue 40 to 50 per cent above California flats I wish to see our home cheese-makers receive some of the profit. It is said that most people like a soft, mild cheese, and the demand is so great on some of our factories for this kind that in one factory in December the cheese went to market when only two days from the hoop. The cheese that is consumed when so new needs to be made by the cheddar process more than the cheese which will not be eaten until six months old, because it is much more easily digested than the cheese which goes into the hoops within forty-five minutes after the whey is drawn, as is the case with most California cheese. Cheese may be made as mild and soft by the cheddar process as by any other, and undoubtedly the consumer would prefer it, after a trial, to the article now so largely in the market. The writer hopes and plans to devote much attention to this question, in both an experimental and commercial way, to the end that California cheese may be second to none in the world.

EDUCATIONAL NEEDS.

The foregoing brief discussion of the conditions at present existing in the dairy industry indicates that there is much need of education in all the lines pertaining to the business. Regarding the breeds of cattle best suited for the various localities, methods by which the herd may be graded up, and most advantageous ways of feeding, there seems no more indifference than there is lack of knowledge of how to do. Many would do better did they know how to go about making improvement and were assured that the suggested steps would prove successful. It is only within the last few years that information about breeding and feeding has been disseminated in portions of the State by means of the Farmers' Institutes and otherwise, and good results are seen to have followed this instruction. Jerseys and Holstein-Friesians are the two dairy breeds which are known to any extent, but it is to be supposed that the Guernsey and Ayrshire have a claim for attention and will prove themselves of much value when wisely introduced. The dairy Shorthorn will always have a place among those who desire to produce both milk and meat.

What is greatly needed in the line of agricultural education is an experimental farm in connection with the State University, where the various breeds of cattle may be kept, and where experiments may be conducted in growing, conserving, and feeding the different fodder and forage crops. The farm should be of sufficient size to accommodate a working number of the leading dairy and beef breeds of cattle; also the more important breeds of horses, sheep, swine, and poultry. The animals should be as near the best of their kind as can be secured, so as to be able to teach the students of the Agricultural College the characteristics peculiar to each breed, and to instill into their minds a love for the *best* in agriculture. It costs no more to feed first class animals than mediocre ones, while the revenues from sales are much more satisfactory in the case of the former.

The farm proper should be equipped with the best tools and machinery that modern invention affords; the barns and stables should be models of their kind as to convenience, comfort of animal, and sanitary condition. In short, it should be to every visitor a model of its kind, and show every farmer of the State what it is possible to do under a strict system of order, cleanliness, and economy. It should teach the farmer objectively how to grow and feed his crops, how to construct his stables, and how to best care for his livestock. For the proper training of all students who take any of the courses in agriculture such a farm is indispensable. Lectures have their purpose, but they are made far more valuable if accompanied by the practical demonstration. In fact, much of the most valuable teaching cannot be done without this illustrative material. It is not to be supposed that the experimental farm would confine its labors and teachings to animal and dairy husbandry. It should include horticulture, viticulture, and all the varied activities of farm life. The farm with its orchards, flocks, and herds would form the basis of experimental work, having inestimable value to all of California's agriculture, and the results of which could be placed in every farmer's library through the means of bulletins.

The need of a well-equipped dairy school is very apparent. The great amount of capital being invested in the dairy and creamery business demands that the State shall supply a place where men may be trained to economically manage these enterprises. In no way can the principles underlying the manufacture of dairy products be so well taught as in a dairy school thoroughly equipped with competent instructors and modern appliances. Having once learned the principles, the student is able to go to any portion of the country and readily apply them to any set or change of conditions. The school, if properly supported, could make itself strongly felt in the improvement of the manufacture of all dairy products.

The proper place for the proposed dairy school would, of course, be on the experimental farm, for a portion at least of the milk needed in the school could be produced at home under known conditions. Moreover, there would be a continual supply of milk throughout the year with which to conduct experiments and utilize the dairy school equipment in a most profitable manner. The dairy school term usually continues from two to three months. But with the building on the farm, students who were able to devote more time could obtain a thorough knowledge of the dairy business from feeding and caring for the cow to the finished butter and cheese.

The poultry industry has assumed large proportions in some portions of the State, and its importance makes necessary some attention to the puzzling questions concerning its future best success. While the matter of breeds most adaptable to our needs may be quite well determined, there are many problems in relation to feeding, incubation, diseases, and the like, which require careful experimentation. The experimental farm could be of great value in fostering and extending this important industry by trying to solve these problems and also by demonstrating the economic correlation of poultry to the dairy.

The writer has noticed a scarcity of mutton breeds of sheep in the State, and is of the opinion that there exists here a place for them and a place which means money to the individuals who will handle them properly. To make a study of the various breeds and their adaptability to our varying conditions is a problem well worth the while of the State University to undertake. Attention could also be profitably paid to the beef and swine industries, making a study along lines similar to those indicated above.

Two reasons make it a paramount necessity that all these divisions of agricultural work should be centralized: First, because they could be more economically administered; second, because only when centralized could they be of the best service to the State in educating all those who attend the College of Agriculture.

It is to be hoped that in addition to the present four-year course in agriculture and in connection with the experimental farm, courses of varying length from two or three months to a year or two may be provided in the College of Agriculture. All farm boys are not able to take a four-year or even a two-year course, but they desire in a short time to gain as much knowledge as possible of the fundamental principles underlying all farm operations and their application to practice. The courses, then, should aim to be made as practical as possible with the view to teach men to be farmers and better farmers. The end of all true education is first to teach men to be *men*, second to equip them in the best and most practical way to be masters of their particular vocation.

WHAT OTHER STATES ARE DOING.

While we are considering the question of agricultural education it may be of interest to know what some Eastern States are providing for the enlightenment of their farm boys and girls. I quote from a circular recently received from Ithaca, New York: "A winter course in agriculture designed to meet the need of busy farmers' sons. The College of Agriculture of Cornell University endeavors to improve the position of the New York farmer in three ways: (1) Through the regular means of instruction given in the special course of two years, the regular course of four years, and the post-graduate courses. These lines of study are designed to meet the desires of those who have time, inclination, and money to complete them. (2) By means of a winter course in agriculture and allied branches, arranged to meet the needs of farmers, gardeners, and their sons, who are unable to spare the time necessary to complete the longer courses, but who are desirous of equipping themselves with a knowledge of the fundamental principles underlying their chosen calling in life. (3) By means of the farmers' reading course, which has been organized to assist the farmers to a better understanding of the truths which are the foundation stones of a successful agriculture." In addition to these courses a winter dairy course of three months is given. All the short courses and the reading course are supported by a special annual appropriation of $35,000 by the New York State Legislature. The dairy school building and equipment were provided by the State at a cost of $50,000.

The University of Wisconsin gives a four-year course in agriculture and in addition a short course covering sixteen weeks during the winter season, with the studies so mapped out as to afford a systematic study for two winters. In the year 1899–1900 the number of young men attending were 87 in the second year and 165 in the first year. During the present season there are in attendance 101 second-year and 196 first-year men. These young men devote the winter to a study of practical farm problems, and go out a hundred-fold better equipped for their daily duties. A dairy course is also given and 120 men are taking work in that, in addition to the 297 men mentioned above. The State of Wisconsin is providing well for the College of Agriculture, because the money thus expended brings ample returns. The buildings and appropriations therefor already given by the State are: Horticulture-physics, $40,000; horse barn, $13,500; dairy barn, $21,000; sheep and swine barn, $4,500; dairy school, $45,000. Addition to latter and central heating plant, $25,000. Total, $124,000. The present Legislature is being asked by the University Board of Regents for $175,000 to erect a general agricultural building, and for an increase of $15,000 in the annual income of the College of Agriculture. The annual expenses of the College and Experiment Station are now over $80,000.

The University of Minnesota announces the various divisions of the Department of Agriculture as the College of Agriculture, School of Agriculture, Dairy School, and Experiment Station. The School of Agriculture is planned something after the idea of an agricultural high school, and intends to give farm boys and girls a training in the natural sciences in their relation to practical home and farm life. The course of study extends through three years, opening about the first of October and closing the latter part of March. The College of Agriculture comprises the regular four-year course, and the Dairy School continues four weeks. The State of Minnesota has provided handsomely for the Agricultural Department and has now supplied buildings to the value of upward of $200,000. The University Board of Regents is asking the present Legislature for $200,000 for a general agricultural building, also for $94,500 worth of special buildings and equipment.

All the other Eastern States are more and more realizing the value of agricultural education and are furnishing equipments to their colleges of varying cost. Ohio erected a large building a few years since at an expense of $200,000. Illinois has just completed one at a cost of $150,000. Iowa's Legislature last year gave its college $15,000 for a new horse barn and stock-judging pavilion. This college has the best equipment of livestock of any in the country. It is valued at $50,000, and comprises twenty-five breeds in all of horses, cattle, sheep, and swine. During the past year surplus stock was sold to the value of $10,000 and additional purchases made of the best individuals to be obtained to an equal amount.

These illustrations will suffice to show how far behind California is in providing for agricultural education and what a bright future may be ours when we give the farm boys and girls such advantages as will enable them to get the most good out of farm life.

AGRICULTURAL EDUCATION.

By BENJ. IDE WHEELER,

President of University of California.

Within the past decade agricultural depression has called into being, in almost all the countries of civilization, rigid governmental inquiry as to causes and remedies. From all sides comes in answer to this inquiry the one demand, though varied in different places in tone and detail,—still the one demand for better products and lower cost of production. This means one certain thing,—nothing more, nothing less:—agriculture, agricultural processes, agricultural life, cannot isolate themselves from the great tide of the world's progress. The fast-rising level of individual human competency, as well as of the rewards of such competency, must make itself felt within the precincts of agricultural life. Intercourse, coöperation, and machinery have made it possible for the individual life in commerce and manufacture to count for vastly more than it could a generation ago, and indeed have made it necessary. No wall or barrier exists between classes and conditions stout enough to defend agricultural life from the tremendous influences of the enhanced productiveness of individual effort in other fields. Conditions which in the older type of human life were provincial have now by active intercourse and interchange been brought into the fierce light of national or international testing. Blind and haphazard effort has been forced to give place to effort planned at long range and in view of wide ranges of facts. Effort based on traditional rules or the rule of thumb has been forced to yield to trained professional effort. Wide-viewed science makes the rules now instead of tradition. Trained intelligence supplants dull plodding ignorance in doing the work.

It is not surprising, therefore, to find that the conclusions reached in all the investigations alluded to lead to the recommendation not so much of more legislation as of more and better education. Legislation, like drugs, may help the patient to turn a sharp corner, or put him in the way to get the full benefit of nature's work, but it does not create health.

The attitude of the public mind with regard to the practical value of research and experimentation in agricultural lines has notably changed within the last decade. Associations of agricultural and horticultural producers throughout the country now advocate liberal promotion of scientific investigation and of instruction based upon the results thereof. Individual producers are choosing materials and shaping policies in accordance with these results and are attaining more satisfactory returns for their labor and investment. Popular understanding of principles underlying agricultural practice has been wonderfully advanced, and has led to hardly less wonderful improvement in the practice. Every line of farm work has been modified and advanced directly or indirectly through the various agencies for agricultural education.

The statistics of attendance at the various agricultural colleges of the country show an increase in the number of students of thirty-three per cent during the last decade. The instruction afforded has improved in even more striking measure. The conception of what instruction may be expected to do and the methods by which it is to proceed have been greatly clarified by experience. The relations of theory and practice have become more clearly discerned. Scientific investigator and practical operator have been drawn closer together and have acquired respect for each other. The result is confidence, mutual interest, progress. In the early days of agricultural education there was some charlatanry afloat. The practical man could not, however, be long imposed upon by mere pedantic devices, for the work of the agricultural teacher comes quickly to its testing at the hands of hard facts. One seldom hears from farmers of to-day the sneering depreciation of scientific work which was all too common and perhaps to some extent deserved a decade or two ago. The main reason is that the sciences involved have learned how to apply themselves, have found how to hook themselves into the needs of actual life.

Nothing is more encouraging in the whole field of agricultural education than the success of various devices which have been evolved for the dissemination of scientific information. We may fairly summarize them all under the head of University Extension. The agricultural experiment stations of the United States published, in 1899, 455 reports and bulletins, aggregating 16,954 pages of the most carefully prepared information on agricultural subjects. These publications were regularly mailed to 523,970 readers. The publications of the United States Department of Agriculture, which has recently become the greatest single agency for the ascertainment and dissemination of agricultural knowledge in the world, are not included in the foregoing. This Department alone published, in 1900, 468 separate publications, aggregating 7,152,428 copies, an increase of 300 per cent since 1893. It is a notable fact that while these huge masses of high-class agricultural information are being cast abroad throughout the country the publication of agricultural periodicals and books by private enterprise has also advanced. Literature of this sort is of a much higher order and is much more liberally patronized than ever before.

The Farmers' Institutes have developed into a solid institution of great value also for the spreading of information and for bringing the instructors in the colleges into personal contact with the farming population and into observation of its conditions and needs. Not to be underestimated, furthermore, is the influence of the extended correspondence continually carried on by the agricultural schools with individuals seeking specific information by letter. The department at Berkeley answers in the course of a year five to six thousand such letters, and many of them contain inquiries which demand special and often prolonged research. A large share of the Director's own time and strength is given to this correspondence.

The work of agricultural education in its various agencies as we have discussed them thus far may be summarized as follows:

1. Investigation or research both in connection with the experiment stations and at the laboratories in Berkeley. This addresses itself to the solution of difficulties and the avoidance of dangers arising in the agricultural practice of the State and to the discovery of new processes and new applications, the testing of new materials, etc.

2. The training of men capable of carrying on and extending this work, capable of advancing the interests of scientific agriculture, capable of aiding in the dissemination of knowledge. Such men may be termed the leaders of progress. A community which lacks such cannot in these days progress. It can only go backward.

3. The contribution of the main elements of agricultural education to the general education of students whose after-life is to be spent on ranches or in farming communities. A very considerable portion of our students are likely either to be farmers or to have interests in farm property, and will find it of great advantage to take some portion of the work offered in the College of Agriculture, even though not registered exclusively as agricultural students. Over twenty per cent of all the students now at Berkeley come from farmers' families. Only a small part of the service rendered to education by the College of Agriculture will be ultimately measured by the number actually registered for the full course in Agriculture.

4. The dissemination of information through Farmers' Institutes, bulletins, correspondence, and short courses, and the solution of special problems through tests, analyses, etc.

There remains a field of education into which the University has not yet entered, but into which in some form, either directly or indirectly, it should be given the means to enter. I refer to the actual work of experimental farming. For university students in agriculture it is by no means essential that the actual manual processes of the farm work should be taught as mere manual processes for the attainment of manual skill, but it is highly desirable that these processes should be continually open to observation and testing and that the opportunity for experimentation in improved processes should be equally open. Particularly in the development of a department of animal industry and dairy husbandry have we come to a point where the establishment of some form of experimental plant is no longer to be avoided. The means, however, fail, except for some slender beginnings. It is to be hoped, furthermore, that in the near future provision may be made whereby schools of practice in all branches of agriculture may be founded, at which, under direction of the College of Agriculture, those not fitted for the higher courses of agricultural instruction and research, or not desiring them, may, during limited periods of precept and demonstration, learn the practical operations which will fit them for actual work according to most approved methods. It is indeed worthy of consideration whether the school recently provided for by legislative grant at San Luis Obispo cannot be given in whole or part such a form.

Berkeley, April 29, 1901.

MAP OF CALIFORNIA.

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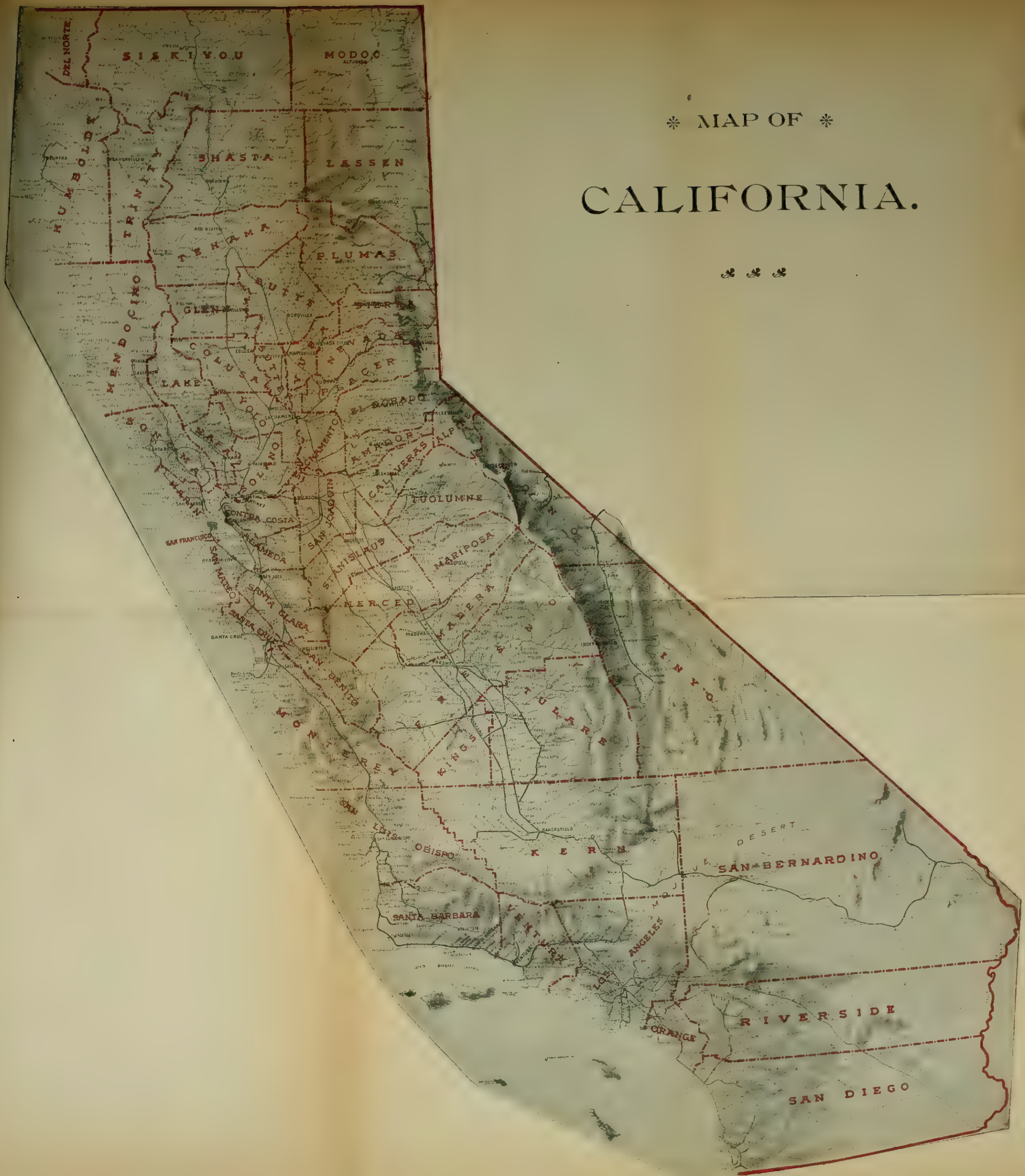

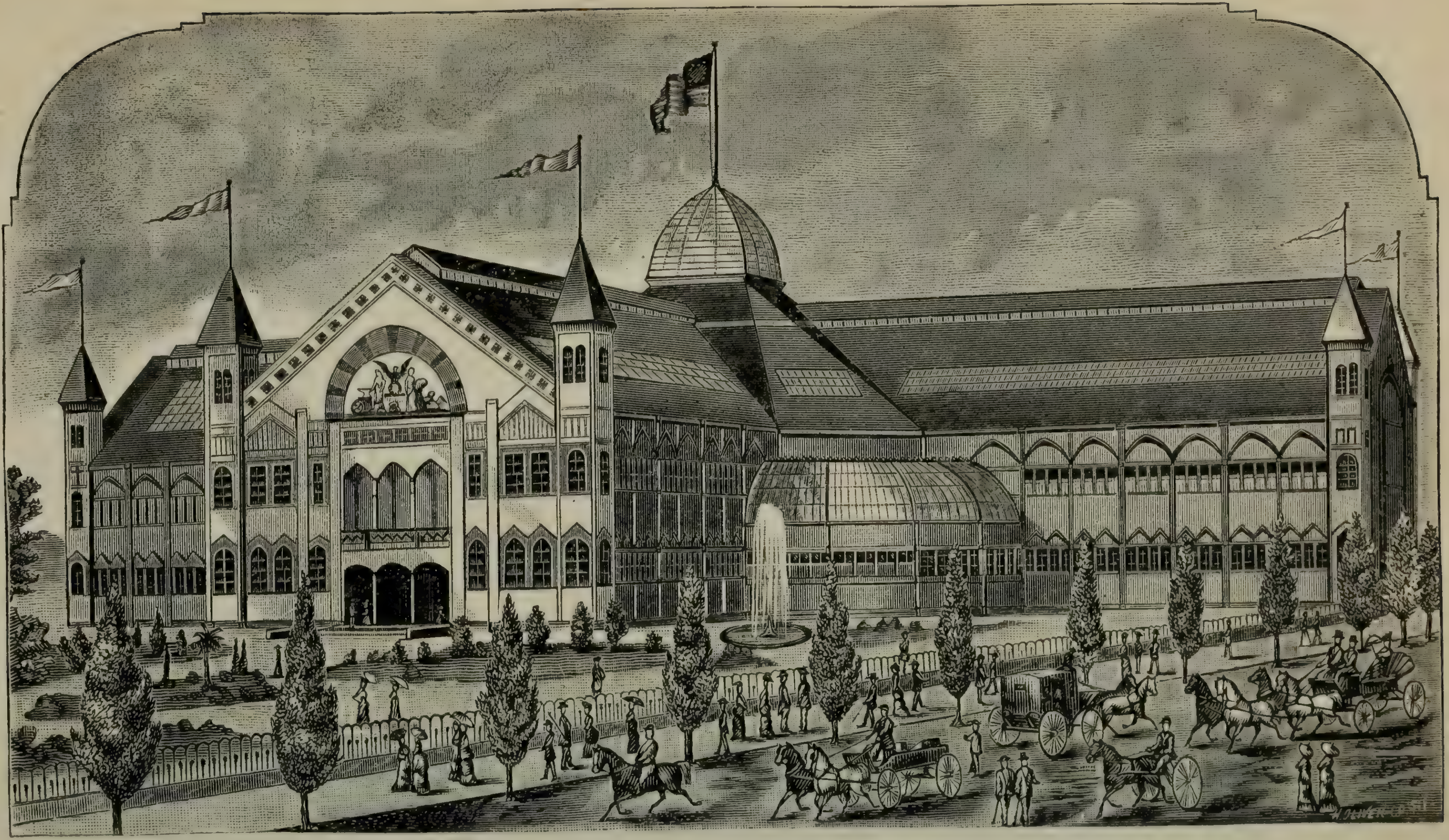

PAVILION OF THE STATE AGRICULTURAL SOCIETY, SACRAMENTO, CALIFORNIA.

TRANSACTIONS

OF THE

CALIFORNIA

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DURING THE YEAR 1901.

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OFFICE OF THE STATE BOARD OF AGRICULTURE,
SACRAMENTO, CAL., February 1, 1902.

To the HON. HENRY T. GAGE, *Governor of California:*

SIR: In compliance with law, we have the honor to submit our annual report for the fiscal year ending January 31, 1902.

The resources of California should be understood and as broadly advertised as possible; with this end in view we have collected complete reports from each county, containing data in relation to general agricultural pursuits, cereal products, horse, cattle, sheep, and swine breeding, and fruit and dairy interests, together with such other information bearing upon the growth and prosperity of California as it is possible to obtain. We feel certain that the information contained in this report will be of great value to the people of the State, and will give to the world at large an idea of what can be accomplished by those who desire to till the fertile soil and exploit the great mineral deposits of California.

Respectfully submitted.

A. B. SPRECKELS,
President.

GEORGE W. JACKSON,
Secretary.

FINANCIAL STATEMENT.

FEBRUARY 1, 1901, TO JANUARY 31, 1902.

SUMMARY.

Receipts.

1901.			
Feb.	1—Cash balance	$1,316 26	
	Rent	1,629 60	
	Bills payable, for bills of 1900	1,180 10	
	Bills payable	8,979 87	
	Park and Pavilion receipts	34,267 30	
	Premiums	15,000 00	
	Races	10,617 50	
	Entrances due, collected	1,079 45	
	Fixed events	4,740 00	
	Bank balance February 1, 1901	2,778 75	
	Bank account overdrawn February 1, 1902	4,048 36	
			$85,565 19

Disbursements.

	Expense	$22,205 10	
	Races	30,355 00	
	Advertising	2,198 13	
	Salaries	5,120 00	
	Premiums	8,974 25	
	Insurance	657 75	
	Interest	3,263 22	
	Bills payable	7,520 46	
	Entrance due	1,025 00	
	Building and improvement	1,632 69	
	Park and Pavilion rebates	1,500 75	
	Rent rebate	250 00	
1902.			
Feb.	1—Cash balance	862 84	
			$85,565 19

RECEIPTS.

1901.			
Feb.	1—Bank balance		$2,778 75
	Cash balance		1,316 26

Races, 1901.

Race	1—The Occident Stake	$325 00	
	2—Pacing purse, 2:12 class	300 00	
	3—Running purse	--------	
	4—Running purse	--------	
	5—Running purse	--------	
	6—Running purse	--------	
	7—Pacing purse, 2:20 class	300 00	
	8—Trotting purse, 2:40 class	720 00	
	9—Running purse	--------	
	10—Flash Stake	270 00	
	11—Running purse	--------	
	12—Running purse	--------	
	13—Pacing Stake, three-year-olds	110 00	
	14—Pacing purse, 2:18 class	200 00	
	Amount carried forward	$2,225 00	$4,095 01

Amount brought forward	$2,225 00	$4,095 01
Race 15—Running purse		
16—Shafter Selling Stake	290 00	
17—Running purse		
18—Running purse		
19—Sacramento Driving Club road race		
20—Trotting purse, 2:14 class	220 00	
21—Running purse	750 00	
22—Sacramento State Fair Stake		
23—Running purse	230 00	
24—Running purse		
25—Trotting purse, 2:20 class	600 00	
26—Drummers' race		
27—Running purse		
28—Running purse		
29—Running purse		
30—Running purse		
31—Pacing purse, 2:17 class	680 00	
32—Running purse		
32A—Running purse		
33—Vinctor Stake	250 00	
34—Futurity Stake	750 00	
34A—Running purse	200 00	
35—Running purse		
36—Stanford Stake	280 00	
37—Trotting purse, special	180 00	
38—Running purse		
39—Running purse		
40—Running purse		
41—Running purse	11 25	
42—Trotting purse, 2:15 class, special	200 00	
43—Sacramento road race, special	180 00	
44—Running purse		
45—Running purse		
46—Running purse, special	150 00	
47—Running purse		
47A—Running purse		
48—Pacing purse, 2:25 class	720 00	
49—Trotting purse, 2:24 class	225 00	
50—Running purse		
51—Running purse		
52—Running purse		
53—Running purse		
54—Pacing purse, 2:13 class	800 00	
55—Pacing purse, special	180 00	
56—Running purse	11 25	
57—Sunny Slope Stake	220 00	
57A—Running purse, handicap	225 00	
58—Governor's handicap	280 00	
59—High weight handicap		
59A—Running purse	200 00	
60—Trotting purse, special	180 00	
61—Pacing purse, special	180 00	
62—Running purse		
63—Running purse		
64—Running purse		
65—Running purse		
65A—Running purse	200 00	
		$10,617 50

PARK AND PAVILION RECEIPTS.

1901.		
Sept. 2—Park ticket sales	$1,230 80	
3—Park ticket sales	347 00	
4—Park ticket sales	455 75	
5—Park ticket sales	515 75	
6—Park ticket sales	628 50	
7—Park ticket sales	733 75	
9—Park ticket sales	784 75	
10—Park ticket sales	587 25	
11—Park ticket sales	804 00	
12—Park ticket sales	1,362 00	
13—Park ticket sales	804 25	
		$8,253 80
Amount carried forward		$22,966 31

Amount brought forward		$22,966 31
Sept. 2—Pavilion ticket sales	$482 75	
3—Pavilion ticket sales	301 00	
4—Pavilion ticket sales	333 75	
5—Pavilion ticket sales	318 50	
6—Pavilion ticket sales	354 25	
7—Pavilion ticket sales	726 50	
9—Pavilion ticket sales	621 50	
10—Pavilion ticket sales	645 00	
11—Pavilion ticket sales	1,036 00	
12—Pavilion ticket sales	925 00	
13—Pavilion ticket sales	985 50	
		$6,729 75
Sweepstakes	$194 00	
Sale of forage	120 45	
Manure privilege	150 00	
Sale of water cart	30 00	
Use of gas by Seventh Ward Club	2 50	
Pool privilege	17,505 00	
Refreshment privilege	505 00	
Programme privilege	705 30	
Jewelry concession	15 00	
Sale of old lumber	1 00	
Gas used by Election Board	5 50	
C. A. Owens, fine	50 00	
		$19,283 75

PREMIUMS.

State warrant for premiums and care of buildings		$15,000 00

BILLS PAYABLE.

J. E. Terry	$855 00	
San Francisco Call	175 00	
San Francisco Examiner	150 00	
San Francisco Chronicle	100 00	
San Francisco Bulletin	100 00	
Tom Scott	155 00	
L. R. Davis	177 00	
J. A. Lafferty	100 50	
B. A. Johnson	451 79	
Melvin & Son	75 20	
George Boyne	408 14	
G. W. Curry	488 97	
Dr. G. W. Dufficy	162 00	
Schaw, Ingram, Batcher & Co.	582 84	
George B. Stack	345 85	
Wood, Curtis & Co.	235 28	
C. W. Paine	166 00	
Miller & Mathews	250 00	
C. H. Krebs & Co.	307 60	
C. M. Campbell	68 15	
Wright & Kimbrough	63 60	
Frank Hickman	69 60	
H. J. Goethe	44 65	
W. P. Coleman Co.	154 05	
Bosqui Engraving Co.	135 00	
Faraday & Co.	42 40	
Shreve & Co.	115 25	
Hawk & Carly	85 00	
California State Bank	213 30	
Wiseman & Wulff	63 70	
Hawley, Bohl & Phillips	37 20	
Curtis, Carmichael & Brand	97 55	
S. Dwyer	57 50	
Friend & Terry Lumber Co.	477 05	
Dr. G. L. Stephenson	50 00	
Sacramento Electric, Gas, and Railway Co.	700 00	
Central California Electric Co.	225 00	
Sacramento Record-Union	267 55	
Sacramento Bee	184 08	
Capital Gas Co.	229 50	
Miller Bros.	140 00	
Phœnix Milling Co.	173 67	
	$8,979 87	
Amount carried forward		$63,979 81

	Amount brought forward	$8,979 87	$63,979 81

For Bills of 1900.

	Tom Scott	$170 10	
	Shreve & Co.	938 00	
			$10,087 97

Entrances Due, Collected.

1901.			
June 27	S. C. Tryon & Co.	$200 00	
Aug. 24	On "Teddy the Roan"	11 25	
	On "El Diablo"	50 00	
	On "Sir Albert S"	105 50	
	Ed. Grazer	31 20	
	On "Advertisor"	55 00	
Oct. 22	On "Lena Hawley"	27 50	
	On "Ida Sultan"	37 25	
	C. D. Jeffries, 1899	55 75	
Dec. 28	On "McBriar"	50 00	
	On "Puerto Rico"	30 00	
	P. Weber	20 00	
	E. Culver	10 00	
	John Mackey	132 00	
	On "Pete S."	10 00	
	S. C. Tryon & Co.	34 00	
	On "Harry J."	10 00	
	C. T. Boots	210 00	
			$1,079 45

Fixed Events.

Occident Stake, 1902	$800 00	
Occident Stake, 1903	945 00	
Occident Stake, 1904	780 00	
Stanford Stake, 1902	290 00	
Stanford Stake, 1903	770 00	
Stallion Stake, 1902	170 00	
Stallion Stake, 1903	200 00	
Stallion Stake, 1902 (foals)	585 00	
Stallion Stake, 1903 (foals)	200 00	
		$4,740 00

Rent.

Rent of Agricultural Park from James Martin	1,629 60
	$81,516 83

DISBURSEMENTS.

Advertising.

1901.		
May 13	Allen's Press Clipping Bureau	$5 00
Sept. 16	F. W. Kelley	345 00
Oct. 1	Signal Publishing Company	10 00
	Newcastle News	5 00
Oct. 30	Western Elk	2 50
Nov. 2	Willows Promoter	5 00
	Stockton Mail	15 00
	San Francisco Call	175 00
	San Francisco Examiner	150 00
	San Francisco Chronicle	100 00
	San Francisco Bulletin	100 00
	Sacramento Bee	184 08
	Sacramento Record-Union	267 55
	Bakersfield Californian	10 00
	Bakersfield Echo	6 00
	Sutter Independent	5 00
	Sutter County Farmer	5 00
	Antioch Ledger	5 00
	San Bernardino Times-Index	5 00
	Chino Champion	5 00
	Merced Sun	6 00
	Nevada City Transcript	10 00
	Amount carried forward	$1,421 13

1901.	Amount brought forward	$1,421 13
Nov. 2—	Grass Valley Telegraph	7 50
	Grass Valley Union	7 50
	Nevada City Herald	5 00
	Willows Journal	5 00
	Ione Echo	5 00
	Amador Ledger	6 00
	Amador Dispatch	6 00
	San Leandro Reporter	7 50
	Livermore Herald	7 50
	Santa Ana Leader	4 50
	Yreka Journal	3 00
	Crescent City News	5 00
	Auburn Republican-Argus	5 00
	Auburn Placer Herald	5 00
	Madera Tribune	5 00
	Visalia Times	7 50
	Winters Express	5 00
	Woodland Democrat	6 00
	Woodland Mail	6 00
	Davisville Enterprise	5 00
	Plumas Independent	5 00
	Placerville Mountain Democrat	5 00
	Placerville Nugget	5 00
	Oroville Register	6 00
	Oroville Mercury	6 00
	Chico Enterprise	6 00
	Modesto News	6 00
	Santa Cruz Sentinel	6 00
	Fresno Republican	15 00
	Fresno Democrat	15 00
	Red Bluff Sentinel	7 00
	Red Bluff People's Cause	5 00
	Red Bluff News	7 50
	Petaluma Courier	7 50
	Santa Rosa Press-Democrat	7 50
	Santa Rosa Republican	10 00
	Santa Rosa Sonoma County Farmer	8 00
	Marysville Appeal	10 00
	Marysville Democrat	5 00
	Salinas Index	6 00
	Downieville Mountain Messenger	6 00
	Stockton Independent	15 00
	Stockton Record	10 00
	Lodi Sentinel	5 00
	Quincy National Bulletin	5 00
	Chico Record	5 00
	Hollister Bee	5 00
	Hollister San Benito Advance	5 00
	Hollister Free Lance	6 00
	Colusa Sun	10 00
	Redding Searchlight	5 00
	Redding Free Press	5 00
	Napa Journal	5 00
	Napa Register	5 00
	Vallejo Chronicle	10 00
	Dixon Tribune	4 00
	Solano Republican	7 50
	San José Fanciers' Monthly	15 00
	Vacaville Reporter	7 50
	Mayfield Republican	7 50
	Sacramento Sunday News	20 00
	Sacramento Sunday Leader	13 00
	Sacramento Nord California Herold	5 00
	Galt Gazette	10 00
	Los Angeles Herald	30 00
	San José Mercury	15 00
	Oakland Enquirer	20 00
	San Francisco Post	50 00
	San Francisco Rural Press	30 00
	San Francisco California Fruit-Grower	20 00
	San Francisco Butchers and Stockgrowers' Journal	5 00
	San Francisco Western Creamery	45 00
	Amount carried forward	$2,090 13

1901.	Amount brought forward	$2,090 13	
Nov. 2	Oakland Tribune	20 00	
	Oak Park Ledger	5 00	
	Santa Barbara Independent	10 00	
	San Francisco Dairy and Produce Review	7 50	
	Pasadena News	10 00	
	Sacramento Liberdade	5 00	
	El Dorado Republican	5 00	
	Berkeley Gazette	10 00	
	Folsom Telegraph	5 00	

BILLS CONTRACTED DURING 1900.

	Bakersfield Echo	7 50	
	Visalia Times	7 50	
	Yreka Journal	3 00	
	Santa Rosa Press-Democrat	7 50	
	Quincy National Bulletin	5 00	
			$2,198 13

EXPENSE.

1901.			
Feb. 4	Postage	$10 00	
15	Sunset Telephone and Telegraph Co.	6 20	
19	Postage	2 00	
Mar. 4	Capital Telephone and Telegraph Co.	3 60	
	Mary Hinkson, engrossing diplomas	1 50	
5	Wm. McLaughlin, cartage	1 50	
	Wells, Fargo & Co.	40	
9	Postage	5 00	
11	Gas tapers	20	
15	Wells, Fargo & Co.	7 45	
29	Postage	5 00	
April 15	Capital Telephone and Telegraph Co.	3 60	
	P. O. box rent	2 50	
	Sunset Telephone and Telegraph Co.	13 25	
	Wm. McLaughlin, cartage	4 35	
	J. L. Dunn, cash paid in error	15 00	
May 1	Postage	10 00	
	W. K. Cothrin, wood	15 25	
6	Capital Telephone and Telegraph Co.	3 50	
13	Postage	10 00	
16	Mason's Laundry	95	
21	Postage	5 00	
22	Sunset Telephone and Telegraph Co.	7 50	
27	Postage	5 00	
June 3	Postage	5 00	
6	Wells, Fargo & Co.	1 15	
	C. Flohr, repairing locks	50	
7	Capital Telephone and Telegraph Co.	3 50	
10	Sunset Telephone and Telegraph Co.	5 50	
14	George Johnson, labor	2 50	
19	Christy & Wise, sundries	24 15	
22	Capital Gas Co., chimneys	15	
25	Postage	5 00	
	M. R. Beard, experting books	30 00	
	Capital Gas Co., mantels	1 35	
July 1	O. P. Dodge, expenses to San Francisco	5 00	
1	Sundries for Directors' meeting	5 50	
2	Wells, Fargo & Co.	70	
	J. E. Kerr, hire of jackscrews	8 00	
	P. O. box rent	2 50	
	H. E. Sleeper, rubber stamps	1 50	
5	Freeport Telephone Co.	50	
11	Capital Telephone and Telegraph Co.	3 60	
	H. Lowden, expenses securing entries 1900	9 00	
15	Postage	15 00	
17	H. E. Sleeper, rubber stamps	2 50	
18	Postage	30 00	
	Sunset Telephone and Telegraph Co.	6 80	
19	Subscription to "Thoroughbred Record"	2 00	
24	P. M. McGuire, hauling dirt	5 50	
	R. H. Hawley, notary fee	1 00	
26	Postage	30 00	
	Subscription to Wallace's Yearbook	4 25	
31	H. E. Sleeper, making zincotype	1 50	
	Amount carried forward	$352 40	$2,198 13

1901.		Amount brought forward	$352 40	$2,198 13
Aug.	2	Postage	5 00	
	3	Wells, Fargo & Co.	65	
		City license to sell pools	500 00	
		H. Lowden, expenses securing entries	21 50	
	9	Capital Telephone and Telegraph Co.	3 75	
		Isidor Cohen, cigars	8 50	
	10	Postage	10 00	
	16	P. O. box key	20	
	17	Sunset Telephone and Telegraph Co.	10 15	
	17	Postage	15 00	
	21	Postage	30 00	
	24	W. H. Higbie, cleaning carpets	10 55	
		National Trotting Association, dues for 1901	100 00	
		National Trotting Association, commissions	15 00	
	26	Postage	20 00	
	27	Postage	20 00	
		W. H. Higbie, cleaning carpets	7 85	
		People's Express, cartage	50	
		Postal Telegraph Co.	55	
		H. E. Sleeper, rubber stamps	2 00	
	29	Mrs. C. B. Herndon, labor on decorations	5 00	
	30	Hale Bros & Co., towels	2 90	
	31	I. Cohen, cigars	8 50	
		Fare for bicycle riders	97 00	
		I. Alexander, expenses securing exhibits	10 00	
Sept.	2	Hale Bros & Co., sundries	3 05	
	5	R. M. Moseley, labor	1 45	
	7	E. A. Bridgford, judging cattle	20 00	
	10	James Logue, riding race	75 00	
		Knights of Pythias, for special Fair attractions	250 00	
		Order of Red Men, for special Fair attractions	175 00	
	11	Wells, Fargo & Co.	25	
	14	I. Alexander, Fair promotion	130 00	
		Henry Berrar, judging poultry	94 85	
		J. J. Calundan, Morse's Patrol	834 30	
		C. H. Porter, music contract	1,960 00	
		Mrs. A. M. Pfeiffer, Fair promotion	50 00	
		Henry Bennett, blacksmithing	75	
	16	D. Dennison, rent of stalls	50 00	
		Postage	5 00	
		C. A. Fisk, electrical work	16 00	
	17	J. G. Genshlea, cigars	2 00	
		J. R. Brown, filing F. W. Leavitt complaint	2 00	
		John Sparks, freight on cattle	119 90	
		Joseph Marzen, freight on cattle	203 06	
		S. E. Watson, paid judges on butter	20 00	
		S. E. Watson, paid judges on machinery	15 00	
		James Martin, whitewashing and work on track	1,316 45	
		E. Phillips, soliciting advertising	32 50	
		E. Phillips, printing programmes	170 85	
		E. Phillips, salary	55 00	
	18	I. Cohen, cigars	8 50	
		Wells, Fargo & Co.	3 75	
		E. W. Culver, livery	20 00	
		Mrs. A. Christie, damages	50 00	
		Sayre & Son, repairing harness	2 50	
		A. O. U. W., for best drilled team	50 00	
		H. Lowden, services as handicapper	120 00	
		J. H. Campbell, cleaning cesspools	30 00	
		P. O. box rent	2 50	
		J. Martin, hack hire	2 50	
Oct.	1	Exchange	30	
		Capital Box Factory, sawdust	7 50	
	4	Shasta Water Co.	8 10	
		P. McGuire, hauling rubbish	5 80	
		L. P. Anderson, painting	22 25	
		Tom Scott, plumbing 1900	170 10	
		Shreve & Co., medals 1900	938 00	
		Second Infantry Band, music	30 00	
		I. P. Christie, cartage	32 00	
		C. T. Barton, refreshments	30 00	
		Burnett & Son, millwork	47 75	
		Amount carried forward	$8,440 96	$2,198 13

1901.	Amount brought forward	$8,440 96	$2,198 13
Oct.	4—Shreve & Co., medal	2 35	
	Sunset Telegraph and Telephone Co.	9 45	
	C. B. Conn, plumbing	7 25	
Oct.	12—Postage	10 00	
	A. J. Wilson, carriage hire	34 00	
	First Regiment Militant Band, music	138 50	
	Lewis Winter, advertising cut	12 00	
	16—James Popert, axle grease	50	
	18—Postal Telegraph Co.	8 35	
	22—Wells, Fargo & Co.	1 80	
	23—Brighton Milling Co., feed	10 85	
	Wyckoff, Seamans & Benedict, rent of typewriter	1 25	
	Dietz & Glendenning, posting bills	2 20	
	Money order	10	
	H. McMillan, teaming at Park	178 00	
	Hicks, Judd & Co., printing posters	125 00	
	29—Baker & Hamilton, hardware	25 82	
	George Z. Wait, disinfectant	40 00	
	W. K. Vanderslice & Co., bill for medals for 1899	33 55	
	Hoit's Electrical Works, electric lamps	9 60	
Nov.	2—B. Wilson & Co., premium ribbon	2 80	
	Holbrook, Merrill & Stetson, hardware	8 05	
	7—Mary Hinkson, engrossing diplomas	22 00	
	Money order	05	
	Capital Telephone Co., use of 'phones	11 60	
	Ing & Allee, drugs	5 85	
	Postage	10 00	
	Mary Hinkson, engrossing diplomas	1 00	
	25—Capital Telephone Co., use of 'phones	8 55	
	Thomson-Diggs Co., hardware	13 75	
	Leroy Anderson, judging premium stock	40 00	
	27—James Popert, feed	34 85	
	Postage	5 00	
Dec.	5—H. Lowden, securing entries 1899	83 50	
	6—Postage	10 00	
	Wells, Fargo & Co.	1 05	
	H. Sleeper, rubber stamps	75	
	10—Postage	5 00	
	18—Postage	6 00	
	23—Capital Telephone Co., use of 'phones	3 50	
	27—Klune & Floberg, medal case	1 00	
1902.			
Jan.	2—Postage	10 00	
	P. O. box rent	2 50	
	4—Wells, Fargo & Co.	1 25	
	9—C. Flohr, repairing locks	35	
	Wells, Fargo & Co.	5 75	
	Capital Manufacturing Co., window sash, etc.	43 20	
	10—Tom Scott, plumbing	155 00	
	J. A. Lafferty, drayage	100 50	
	B. A. Johnson, caring for Directors' stand	451 79	
	Melvin & Son, iron rods for Pavilion	75 20	
	George Boyne, decorating Pavilion	408 14	
	Dr. G. W. Dufficy, medical attendance for injured jockeys	162 00	
	George B. Stack, plumbing	345 85	
	Fashion Stable, livery hire	166 00	
	L. R. Davis, straw for premium stock	177 00	
	G. W. Curry, hay for preminm stock	488 97	
	Wood, Curtis & Co., hay for premium stock	235 28	
	Miller & Mathews, barbecue dancing platform	250 00	
	C. M. Campbell, repairing chairs and rent on furniture	68 15	
	Bosqui Engraving Co., diplomas	135 00	
	Shreve & Co., medals	115 25	
	S. Dwyer, sundries	57 50	
	Dr. G. L. Stevenson, medical attendance	50 00	
	Sacramento Electric, Gas, and Railway Co., lights	700 00	
	Central California Electric Co., lights	225 00	
	Capital Gas Co., gas	229 40	
	W. K. Cothrin, wood	10 00	
	F. H. Veach, repairing turnstiles	30 50	
	California Winery, wines	45 75	
	Sunset Telephone Co., use of 'phones	34 15	
	Amount carried forward	$14,145 31	$2,198 13

1902.	Amount brought forward	$14,145 31	$2,198 13
Jan. 10—	John Breuner Co., re-covering lounge	31 00	
	Derman & Blundell, gold medal	20 00	
	A. S. Hopkins Co., sundries	31 40	
	T. D. Scriver, hack hire	2 00	
	Sacramento Directory Co., directory	4 00	
	George B. Stack, plumbing	2 40	
	Kirk-Geary Co., disinfectant	11 55	
	D. Johnston & Co.	12 85	
	R. O. Kimbrough, hardware	8 70	
	Egan Bros., repairing filter	3 80	
	Hale Bros. & Co., cloth	3 50	
	A. A. Killen, painting signs	26 50	
	Western Union Telegraph Co., telegrams	74 40	
	W. A. Caswell, posting bills	27 75	
	W. F. Purnell, office supplies	1 40	
	Kane & Trainor Ice Co., ice	75 65	
	Wells, Fargo & Co., expressage	52	
	H. S. Crocker & Co., office supplies	36 70	
	John F. Farley, cigars, 1899	12 00	
	Owens, Varney & Green, posting bills	27 00	
	Sanborn, Vail & Co., repairing pictures	25 65	
	George E. Spencer, posting bills	10 00	
	Goodwin Bros., subscription to Official Turf Guide	18 00	
	Hevener & Mier, framing pictures	55	
	Postage	15 00	
	Capital Telephone Co., use of 'phones	3 50	
	Phœnix Milling Co., feedstuffs	173 67	
	Z. Harris, papers containing statistics for report	30	
	Hevener & Mier, framing pictures	1 95	
	C. Flohr, repairing locks	25	
			$14,807 30

Park Preliminary Payroll, 1901.

1901.			
Sept. 2—	William Roberts, carpenter	$212 00	
	John Renfro, carpenter	156 00	
	Patrick Burns, laborer	94 00	
	E. Diggs, laborer	68 00	
	Victor Gilbert, laborer	8 00	
	R. Frazee, laborer	68 00	
	S. Hinton, laborer	12 00	
	R. M. Moseley, laborer	8 00	
	A. E. Craw, laborer	58 00	
	J. McCracken, carpenter	12 00	
	J. Emerald, carpenter	15 00	
	D. Enright, laborer	10 00	
	George Mercer, carpenter	13 50	
	Charles Bard, trackman	35 00	
	Lee Stout, trackman	12 00	
	J. Fitzgerald, trackman	12 00	
	C. Langdon, laborer	4 00	
	M. Johnson, janitor	15 00	
	Ed. Fitzgerald, laborer	8 00	
	H. Whitaker, laborer	8 00	
			$828 50

Park Payroll.

Sept. 14—	William Fieldwick, superintendent of track	$125 00	
	John Renfro, laborer	12 00	
	D. Enright, laborer	10 00	
	H. Whitaker, laborer	10 00	
	William Roberts, carpenter	60 00	
	E. Diggs, laborer	32 00	
	R. Frazee, laborer	49 00	
	E. A. Craw, laborer	49 00	
	Patrick Burns, laborer	8 00	
	Charles Bard, laborer	40 50	
	William Hartman, handler starting-gate	30 50	
	M. Johnson, care of stands	17 50	
	Lee Stout, laborer	28 00	
	John Fitzgerald, laborer	28 00	
	Ed. Ferguson, laborer	26 00	
	C. Slaughter, laborer	24 00	
	C. Yates, laborer	8 00	
	Amount carried forward	$557 50	$17,833 93

1901.	Amount brought forward	$557 50	$17,833 93
Sept. 14—	P. Hardy, laborer	7 00	
	F. Norman, laborer	7 00	
	G. Lyons, laborer	5 00	
	J. L. Dunn, financial secretary	150 00	
	C. W. Samuelson, assistant forage clerk	21 00	
	E. J. Clark, chief ticket clerk	48 00	
	Charles Ellsworth, ticket clerk	24 00	
	Julius Jacobs, ticket clerk	24 00	
	Thomas Finnegan, ticket clerk	22 00	
	L. Handlin, ticket clerk	8 00	
	Thomas Flannagan, ticket clerk	22 00	
	Ed. Barron, ticket clerk	24 00	
	D. J. Long, ticket clerk	22 00	
	John Creamer, ticket clerk	18 00	
	Fred Chase, entry clerk	70 00	
	W. W. Coons, forage clerk	48 00	
	C. Samuelson, placing stalls	50 00	
	L. J. Chrisler, assistant superintendent	75 00	
	H. S. Beals, usher	22 00	
	J. M. Shannon, gatekeeper	22 00	
	A. Dassonville, gatekeeper	22 00	
	Timothy Lynch, gatekeeper	27 50	
	Roy Hart, gatekeeper	22 00	
	P. Pendergast, gatekeeper	22 00	
	John F. Dreman, gatekeeper	22 00	
	Morris Haley, watchman	12 00	
	Henry Furry, watchman	12 00	
	P. O'Harra, watchman	22 00	
	E. H. Hoppe, watchman	36 00	
	C. Murchison, mounted police	20 00	
	T. L. Acock, watchman	12 00	
	F. Kunz, messenger boy	22 00	
	C. W. Aby, watching cattle sheds	24 00	
	Monroe Johnson, porter judges' stand	27 50	
	Tony Gregory, caring for closets	22 00	
	M. Karcher, watchman	22 00	
	W. K. Miller, hay, day watchman	34 00	
	D. Maloney, hay, night watchman	32 00	
	Charles Schlutius, mounted police	22 00	
	William Napier, gatekeeper	33 00	
	D. J. Considine, gatekeeper	22 00	
	J. W. Brooks, starter running races	220 00	
	P. E. Jones, assistant starter running races	55 00	
	W. Dorsey, whipper-in	55 00	
	B. Rush, timers' flag	27 50	
	E. S. Culver, clerk of course	60 00	
	J. Bronner, clerk of scales	90 00	
	R. Shields, marshal	60 00	
	J. Dinue, assistant marshal	55 00	
	A. O. Manning, caring for arm numbers	30 00	
	C. Ingham, caring for jockey and blackboards	55 00	
	Thomas Halpin, caring for jockey-room	51 50	
	James Sullivan, timer	44 00	
	J. C. Wolfskill, timer	40 00	
	S. McGibbin, overnight programme	33 00	
	James Cole, porter	22 00	
	W. D. Nichols, special police	36 00	
	R. Mosley, laborer	3 00	
	William Napier, watchman	12 00	
	P. E. Jones, watchman	8 00	
	E. H. Hoppe, watchman	6 00	
	George J. Johnson, office work	35 00	
	Thomas J. Dunn, counting tickets	46 00	
			$2,780 50

PAVILION PRELIMINARY PAYROLL.

Sept. 2—	D. Falconer, carpenter	$290 50	
	Thomas Twaddle, laborer	36 00	
	J. M. Tenbrook, laborer	56 50	
	A. Galleoto, laborer	55 00	
	A. McDonell, laborer	51 50	
	Grove Fink, laborer	72 50	
	T. W. Haynie, laborer	36 50	
	Amount carried forward	$598 50	$20,614 43

1901.	Amount brought forward	$598 50	$20,614 43
Sept. 2—	W. H. H. Willey, laborer	54 25	
	A. Latson, laborer	26 50	
	George Davis, laborer	8 50	
	J. B. Hill, laborer	5 50	
	W. S. Cannon, watchman	5 00	
	O. Collier, carpenter	97 50	
	George Mercer, carpenter	7 50	
	Jesse Emerald, carpenter	7 50	
	P. Anderson, messenger	4 00	
	George A. Warner, laborer	10 50	
	E. D. Young, laborer	5 00	
	H. Garrett, laborer	9 50	
	Theodore Suchau, laborer	41 75	
	J. W. Collins, laborer	34 25	
	Charles Ott, carpenter	34 50	
	George J. Johnson, clerk	75 00	
	J. Donnalle, laborer	3 50	
	R. Helms, laborer	5 00	
	A. Hunter, laborer	3 50	
	T. W. Measure, laborer	7 00	
	J. H. Dodge, laborer	18 00	
	E. G. McCann, laborer	12 50	
	O. R. Rush, laborer	12 50	
	E. Hubert, laborer	38 50	
	William Conley, laborer	30 45	
	Sadie Paine, clerk	54 00	
			$1,210 20

Pavilion Payroll.

Sept. 14—	D. Falconer, carpenter	$122 50	
	W. Conley, laborer	63 50	
	G. A. Warner, laborer	69 00	
	A. McDonell, laborer	66 75	
	A. Galleoto, laborer	66 50	
	R. Helms, laborer	48 25	
	G. Fink, laborer	44 85	
	H. Garrett, laborer	43 25	
	E. Hubert, laborer	69 50	
	A. Latson, laborer	45 50	
	G. Davis, laborer	33 75	
	W. H. H. Willey, laborer	71 50	
	J. W. Collins, laborer	62 50	
	S. W. Haynie, laborer	46 50	
	J. B. Hill, laborer	67 00	
	O. R. Rush, laborer	51 00	
	J. M. Tenbrook, laborer	66 50	
	Theodore Suchau, laborer	65 00	
	E. G. McCann, laborer	42 75	
	J. Donnalle, laborer	40 25	
	A. Hunter, laborer	13 00	
	P. J. Coffey, laborer	34 75	
	Charles Cooley, laborer	34 50	
	C. V. Garrett, watchman	39 00	
	Thomas Jones, laborer	2 00	
	J. C. Collins, laborer	22 50	
	Julius Jacobs, laborer	5 00	
	Timothy Lee, watchman	35 00	
	W. S. Canon, watchman	58 50	
	Jesse Podd, watchman	24 00	
	P. Anderson, messenger	19 00	
	P. Mamegowena, labor in Art Department	43 50	
	Mrs. A. Quigley, caring for cases	49 50	
	Mrs. Lawler, caring for ladies' room	22 00	
	Mrs. Chalmers, caring for ladies' room	24 00	
	H. W. Gardiner, clerk	6 00	
	John Creamer, clerk	21 00	
	C. M. Prodger, ticket clerk	33 00	
	Ira Jones, ticket clerk	33 00	
	Mrs. A. R. Fink, entry clerk	48 00	
	Mrs. E. G. Clark, entry clerk	48 00	
	Mrs. A. Chipman, entry clerk	51 00	
	Charles Trainor, chief ticket clerk	44 00	
	Amount carried forward	$1,896 60	$21,824 63

1901.	Amount brought forward	$1,896 60	$21,824 63
Sept. 14	Charles Trainor, procuring exhibits	20 00	
	John A. Stanton, Superintendent of Art Department	200 00	
	S. E. Watson, Superintendent of Dairy Department	200 00	
	J. F. Bronner, office work	10 00	
	O. P. Dodge, Superintendent of Pavilion	150 00	
	Sadie Paine, assistant financial secretary	39 00	
	George J. Johnson, office work	15 00	
	Katie Haley, clerk	18 00	
	M. Coffey, Superintendent of Poultry Department	30 00	
			$2,578 60

RACES, 1901.

Race 1	The Occident Stake	$2,595 00	
2	Pacing purse, 2:12 class	500 00	
3	Running purse	225 00	
4	Running purse	250 00	
5	Running purse	225 00	
6	Running purse	225 00	
7	Pacing purse, 2:20 class	500 00	
8	Trotting purse, 2:40 class	800 00	
9	Running purse	225 00	
10	Flash Stake	670 00	
11	Running purse	250 00	
12	Running purse	225 00	
13	Pacing stake, 3-year-olds	360 00	
14	Pacing purse, 2:18 class	400 00	
15	Running purse	225 00	
16	Shafter Selling Stake	590 00	
17	Running purse	250 00	
18	Running purse	225 00	
19	Sacramento Driving Club road race	400 00	
20	Trotting purse, 2:14 class	1,000 00	
21	Running purse	250 00	
22	Sacramento State Fair Stake	630 00	
23	Running purse	250 00	
24	Running purse	200 00	
25	Trotting purse, 2:20 class	800 00	
26	Drummers' race	250 00	
27	Running purse	225 00	
28	Running purse	225 00	
29	Running purse	225 00	
30	Running purse	225 00	
31	Pacing purse, 2:17 class	800 00	
32	Running purse	250 00	
32A	Running purse	225 00	
33	Vinctor Stake	650 00	
34	Futurity Stake	2,250 00	
34A	Running purse	200 00	
35	Running purse	250 00	
36	Stanford Stake	1,260 00	
37	Trotting purse, special	400 00	
38	Running purse	250 00	
39	Running purse	250 00	
40	Running purse	225 00	
41	Running purse	225 00	
42	Trotting purse, 2:15 class, special	400 00	
43	Sacramento road race, special	400 00	
44	Running purse	225 00	
45	Running purse	225 00	
46	Running purse, special	400 00	
47	Running purse	225 00	
47A	Running purse	200 00	
48	Pacing purse, 2:25 class	800 00	
49	Trotting purse, 2:24 class	500 00	
50	Running purse	225 00	
51	Running purse	225 00	
52	Running purse	250 00	
53	Running purse	225 00	
54	Pacing purse, 2:13 class	1,000 00	
55	Pacing purse, special	400 00	
56	Running purse	225 00	
57	Sunny Slope Stake	520 00	
	Amount brought forward	$27,100 00	$24,403 23

Amount brought forward	$27,100 00	$24,403 23
Race 57A—Running purse, handicap	225 00	
58—Governor's Handicap	680 00	
59—High weight handicap	250 00	
59A—Running purse	200 00	
60—Trotting purse, special	400 00	
61—Pacing purse, special	400 00	
62—Running purse	225 00	
63—Running purse	250 00	
64—Running purse	200 00	
65—Running purse	225 00	
65A—Running purse	200 00	
		$30,355 00

PREMIUMS.

First Department	$3,750 50	
Poultry	622 00	
Second Department	298 00	
Third Department	330 75	
Fourth Department	453 50	
Fifth Department	481 00	
Sixth Department	1,232 00	
Seventh Department	77 50	
Eighth Department	859 00	
Ninth Department	870 00	
		$8,974 25

ENTRANCES DUES.

National Trotting Association (S. C. Tryon)	$175 00	
Race 7—"Nellie I."	25 00	
8—"Pearl K."	40 00	
10—"Moccorito"	10 00	
10—"Roundhead"	10 00	
10—"Doublet"	10 00	
13—"Pearl Sinclair"	20 00	
16—"Sol"	10 00	
16—"Maraschino"	10 00	
20—"McBriar"	50 00	
20—"G. W. McKinney"	50 00	
22—"Rio Chico"	10 00	
22—"Jim Hale"	10 00	
32—"Advertisor"	40 00	
31—"Nellie I."	40 00	
31—"Little Maid"	40 00	
34—Elmwood Stock Farm	185 00	
36—J. Rea	10 00	
36—L. McCullum	10 00	
48—"Celmar"	40 00	
48—"Advertisor"	40 00	
40—"Nellie I."	40 00	
54—"King Cadenza"	50 00	
54—"Nellie I."	50 00	
54—"Advertisor"	50 00	
		$1,025 00

SALARIES.

George W. Jackson, Secretary	$1,400 00	
H. Lowden, Assistant Secretary	1,500 00	
Leon R. Miller, Stenographer	720 00	
Charles B. Herndon, Janitor	900 00	
D. M. Cox, Watchman	600 00	
		$5,120 00

BILLS PAYABLE.

James Touhey	$702 00	
George Boyne	415 00	
W. F. Frazer	986 35	
A. K. Wackman	192 57	
Central California Electric Co.	235 25	
Meiss Bros.	194 50	
Friend & Terry Lumber Co.	296 40	
J. W. Wilson	205 00	
A. Meister & Sons	154 05	
John Mackey	250 00	
Amount brought forward	$3,631 12	$69,877 48

Amount brought forward	$3,631 12	$69,877 48
J. Lafferty	112 50	
Tom Scott	170 10	
Grafmiller Bros.	126 48	
Hale Bros. & Co.	165 04	
Sacramento Electric, Gas, and Railway Co.	716 64	
Brighton Milling Co.	143 64	
California State Bank	213 00	
Capital Gas Co.	268 46	
C. H. Krebs & Co.	161 45	
Shreve & Co.	938 00	
George B. Stack	874 03	
		$7,520 46

BUILDING AND IMPROVEMENT.

Friend & Terry Lumber Co.	$520 25	
Schaw, Ingram, Batcher & Co.	582 84	
C. H. Krebs & Co.	307 60	
Miller Bros.	140 00	
Herndon & Haley	55 00	
T. J. Pennish	27 00	
		$1,632 69

INTEREST.

June 27	California State Bank	$213 30	
Sept. 10	D. O. Mills, on James Touhey note	31 59	
	D. O. Mills, on George Boyne note	20 75	
	D. O. Mills, on sundry notes	2,443 00	
Oct. 10	Shreve & Co., on note	42 21	
	George B. Stack, on note	43 70	
1902.			
Jan. 1	California State Bank	213 30	
31	D. O. Mills & Co.	255 37	
			$3,263 22

INSURANCE.

Wright & Kimbrough	$63 60	
Frank Hickman	69 60	
H. J. Goethe	44 65	
W. P. Coleman Company	154 05	
Farady & Co.	42 40	
Hawk & Carly	85 00	
Wiseman & Wulff	63 70	
Hawley, Bohl & Phillips	37 20	
Curtis, Carmichael & Brand	97 55	
		$657 75

PARK AND PAVILION REBATES.

Cæsar Young, rebate on pool privilege	$1,458 75	
C. T. Barton, rebate on refreshment privilege	42 00	
		$1,500 75

RENT REBATE.

James Martin		250 00
		$84,702 35

PREMIUMS AWARDED—1901.

FIRST DEPARTMENT—LIVE STOCK.

HORSES.

Exhibit.	Exhibitor.	Award.
CLASS I—THOROUGHBRED HORSES.		
Stallions.		
First Tenor, best four years old and over	Burns & Waterhouse, San Fran.	$30 00
Thornhill, second best	Lone Stable, Sacramento	15 00
Impressario, best three-year-old	Mrs. E. F. Smith, Sacramento	10 00
Discovery, best two-year-old	Lone Stable, Sacramento	15 00
George Clark, second best	Mrs. E. F. Smith, Sacramento	7 50
——, best one-year-old	Lone Stable, Sacramento	10 00
——, second best	E. D. McSweeney, El Monte	5 00
——, best colt under one year	La Siesta Ranch, San José	7 50
——, second best	Lone Stable, Sacramento	5 00
Mares.		
Imp. Elise, best four years old and over, with colt	Lone Stable, Sacramento	30 00
Wandering Nun and colt, second best	La Siesta Ranch, San José	15 00
Dame Margery, best four years old and over	Lone Stable, Sacramento	20 00
——, best three-year-old	E. D. McSweeney, El Monte	7 50
Nonic, best two-year-old	E. D. McSweeney, El Monte	10 00
Conch, second best	Lone Stable, Sacramento	5 00
——, best one-year-old	Lone Stable, Sacramento	7 50
——, second best	E. D. McSweeney, Sacramento	5 00
——, best filly under one year	Lone Stable, Sacramento	7 50
——, second best	E. D. Purser, Sacramento	5 00
Families.		
Wandering Nun and two colts, best thoroughbred dam	La Siesta Ranch, San José	30 00
Abbie Woodnut and two colts, best dam other than thoroughbred	Mrs. E. W. Callendine, Sac'to	30 00
CLASS II—STANDARD TROTTERS.		
Stallions.		
Boodle Jr., best four years old and over	Jesse D. Carr, Salinas	30 00
On Stanley, second best	Santa Rosa Stock Farm, Santa Rosa	15 00
Zuomi, best two-year-old	Tuttle Bros., Rocklin	15 00
Prince Rio, second best	J. B. Iverson, Salinas	7 50
The Jester, best one-year-old	L. H. Todhunter, Sacramento	10 00
Guymot, second best	Mrs. E. W. Callendine, Sac'to	5 00
Prince Howard, best gelding	E. P. Heald, San Francisco	10 00
Mares.		
Mary Lou, best four years old and over, with colt	Mrs. N. E. McCord, Sacramento	15 00
Abbie Woodnut, best four years old and over	Mrs. E. W. Callendine, Sac'to	20 00
Lady Bellisle, second best	La Siesta Ranch, San José	10 00
Lady Keating, best three-year-old	Mrs. E. W. Callendine, Sac'to	15 00
Zaza, best suckling colt	Mrs. N. E. McCord, Sacramento	5 00

First Department—Horses—Continued.

Exhibit.	Exhibitor.	Award.
CLASS III—ROADSTERS.		
Don C, best roadster gelding	Mrs. Frank Tryon, Sacramento	$20 00
Doc, second best	Young & Co., Sacramento	10 00
Maud, best roadster mare, four years old and over	W. H. Sayre, Sacramento	20 00
CLASS IV—COACH HORSES.		
Stallions.		
Dametal II, best four years old and over	Dr. J. J. Summerfield, Santa Rosa	30 00
Y. Adonis, second best	W. A. French, Stockton	15 00
Boxwood, Jr., best three-year-old	H. S. Moddison, Broderick	20 00
Lynwood, second best	H. H. Wilson, Marysville	10 00
General, best two-year-old	H. S. Moddison, Broderick	15 00
Just in Time, second best	H. H. Wilson, Marysville	7 50
On Time, best one-year-old	H. H. Wilson, Marysville	10 00
Young Wonder, second best	H. S. Moddison, Broderick	5 00
——, best suckling colt	Dr. J. J. Summerfield, Santa Rosa	7 50
——, second best	H. H. Wilson, Marysville	5 00
Lyman, best gelding	Henry Klemp, Pleasant Grove	5 00
Mares.		
Fannie, best four years old and over, with colt	H. H. Wilson, Marysville	30 00
Maud and colt, second best	Dr. J. J. Summerfield, Santa Rosa	15 00
Maud, best four years old and over	A. D. Miller, Sacramento	20 00
Josie, second best	H. S. Moddison, Broderick	10 00
Lilly, best three-year-old	H. H. Wilson, Marysville	15 00
Belle, second best	H. S. Moddison, Broderick	7 50
Maud, best two-year-old	T. A. Nuffer, Sonoma	10 00
Pet, second best	H. H. Wilson, Marysville	5 00
Susie, best one-year-old	H. S. Moddison, Broderick	7 50
Daisy, second best	H. H. Wilson, Marysville	5 00
——, best suckling filly	H. H. Wilson, Marysville	7 50
——, second best	H. S. Moddison, Broderick	5 00
CLASS V—CARRIAGE TEAMS.		
Best span	Dr. A. McCollum, Sacramento	40 00
Second best	Henry Klemp, Pleasant Grove	20 00
CLASS VI—ROADSTER TEAMS.		
Best span	R. E. Mulcahy, Sacramento	30 00
Second best	Henry Klemp, Pleasant Grove	15 00
CLASS VI A—FANCY TRAPS, PHAETONS, CARTS, OR SIMILAR VEHICLES.		
Best trap	Mrs. H. O. Buckman, Sacramento	15 00
Second best	Harris & Cook, Sacramento	10 00
CLASS VII—NORMANS OR PERCHERONS.		
Stallions.		
Hercules, best four years old and over	Minnewawa Stock Farm, Fresno	30 00
Laguna, second best	J. A. Beall, Laton	15 00
——, best suckling colt	J. A. Beall, Laton	5 00
Mares.		
Isabella, best four years old and over, with colt	Minnewawa Stock Farm, Fresno	30 00
Laura and colt, second best	J. A. Beall, Laton	15 00
——, best suckling filly	Minnewawa Stock Farm, Fresno	5 00

First Department—Horses—Continued.

Exhibit.	Exhibitor.	Award.
CLASS X—ENGLISH SHIRES.		
Stallions.		
Pride of the Prairie, best four years old and over	Meek Estate, Haywards	$30 00
California Tom, second best	Dr. J. J. Summerfield, Santa Rosa	15 00
CLASS XI—MISCELLANEOUS.		
Stallions.		
Pompeii, Jr., best four years old and over	L. M. Ladd, Hollister	30 00
Honest John, second best	Dr. J. H. Shirley, Sacramento	15 00
Pluto, best three-year-old	Meek Estate, Haywards	20 00
Silver Cloud, second best	P. Carroll, Mayhews	10 00
Shamrock, best two-year-old	Meek Estate, Haywards	15 00
Concord, second best	Joseph Kiser, Napa	7 50
Bay Prince, best one-year-old	Joseph Kiser, Napa	10 00
Prince S., second best	T. A. Nufer, Sonoma	5 00
——, best suckling colt	Joseph Kiser, Napa	7 50
——, second best	J. A. Beall, Laton	5 00
Mares.		
Martha, best four years old and over, with colt	Minnewawa Stock Farm, Fresno	30 00
Lize and colt, second best	Henry Klemp, Pleasant Grove	15 00
Lize, best four years old and over	Henry Klemp, Pleasant Grove	20 00
Dappy, second best	La Siesta Ranch, San José	10 00
Sadie, best three-year-old	H. H. Wilson, Marysville	15 00
Jane, second best	H. S. Moddison, Broderick	7 50
Annie, best two-year-old	P. Carroll, Mayhews	10 00
Mary, best one-year-old	Joseph Kiser, Napa	7 50
Sallie, second best	H. S. Moddison, Broderick	5 00
——, best suckling filly	Minnewawa Stock Farm, Fresno	7 50
——, second best	Henry Klemp, Pleasant Grove	5 00
CLASS XII—SADDLE HORSES.		
——, best saddle horse	E. E. Maxwell, Sacramento	20 00
——, second best	Henry Klemp, Pleasant Grove	10 00
CLASS XIV—JACKS AND JENNIES.		
Jacks.		
Sampson, best three years old and over	Henry Klemp, Pleasant Grove	20 00
Prince, second best	H. H. Wilson, Marysville	10 00
Jackie, best suckling	Henry Klemp, Pleasant Grove	5 00
Jennies.		
Sallie, best three years old and over	Henry Klemp, Pleasant Grove	15 00
Mollie, second best	H. H. Wilson, Marysville	5 00
Mules.		
Best matched span, three years old and over, California bred	Henry Klemp, Pleasant Grove	15 00
Best two-year-old	Henry Klemp, Pleasant Grove	5 00
Best suckling	Henry Klemp, Pleasant Grove	5 00

CATTLE.

CLASS I—SHORTHORNS.		
Bulls.		
Sharon Victor VI, best three years old and over	Joseph Marzen, Lovelock, Nev.	$30 00
Block, second best	W. B. Gibson, Woodland	15 00
W. J. Bryan, best two-year-old	W. B. Gibson, Woodland	10 00
Nevada Boy XXXIX, best one-year-old	Joseph Marzen, Lovelock, Nev.	15 00
Humboldt Victor V, second best	Joseph Marzen, Lovelock, Nev.	7 50
Humboldt Victor XIII, best bull calf	Joseph Marzen, Lovelock, Nev.	10 00
King Spicy X, second best	W. H. Howard, Newman	5 00

First Department—Cattle—Continued.

Exhibit.	Exhibitor.	Award.
Cows.		
Lady Elgin IV, best three years old and over	Joseph Marzen, Lovelock, Nev.	$30 00
Sharon Rose of Maple Hill, second best	Joseph Marzen, Lovelock, Nev.	15 00
Humboldt Maid VI, best two-year-old	Joseph Marzen, Lovelock, Nev.	20 00
Lassie, second best	W. B. Gibson, Woodland	10 00
Amelia B David XVIII, best one-year-old	Joseph Marzen, Lovelock, Nev.	7 50
Belle of Woodland II, best heifer calf	W. B. Gibson, Woodland	10 00
Waterfall IX, second best	Joseph Marzen, Lovelock, Nev.	5 00
Herds.		
Sharon Victor VI and four cows, best herd over two years	Joseph Marzen, Lovelock, Nev.	40 00
Sweepstakes.		
Sharon Victor VI, best bull any age	Joseph Marzen, Lovelock, Nev.	48 00
Duchess of Humboldt VIII, best cow any age	Joseph Marzen, Lovelock, Nev.	48 00
CLASS III—HEREFORDS.		
Bulls.		
McCord, best three years old and over	John Sparks, Reno, Nev.	30 00
The Grove, second best	John Sparks, Reno, Nev.	20 00
Perfection, best one-year-old	John Sparks, Reno, Nev.	15 00
Cows		
Ida May, best three years old and over	John Sparks, Reno, Nev.	30 00
Ethel Alamo, best two-year-old	John Sparks, Reno, Nev.	20 00
Phœbe Alamo, best one-year-old	John Sparks, Reno, Nev.	10 00
Fairview Alamo, best heifer calf	John Sparks, Reno, Nev.	10 00
Herds.		
McCord and four cows, best herd two years old and over	John Sparks, Reno, Nev.	40 00
Perfection II and four cows, best herd under two years	John Sparks, Reno, Nev.	20 00
Sweepstakes.		
Perfection II, best bull any age	John Sparks, Reno, Nev.	44 00
Ida May, best cow any age	John Sparks, Reno, Nev.	44 00
CLASS VI—HOLSTEINS.		
Bulls.		
Mechthildus, best three years old and over	F. H. Burke, San José	30 00
Accula II Netherland, best two-year-old	F. H. Burke, San José	10 00
Portland King II, best one-year-old	F. H. Burke, San José	7 50
Mabel Haskin's 3rd Emperor, best bull calf	F. H. Burke, San José	5 00
Cows.		
Buttercup De Kol, best three years old and over	F. H. Burke, San José	15 00
Maid Gerben, best two-year-old	F. H. Burke, San José	10 00
Lill De Kol, best one-year-old	F. H. Burke, San José	7 50
——, best heifer calf	F. H. Burke, San José	5 00
Herds.		
Mechthildus and four cows, best herd two years old and over	F. H. Burke, San José	20 00
Capt. Pietertly and four cows, best herd under two years	F. H. Burke, San José	10 00
Mabel Haskin's 3rd Emperor and four females, best calf herd	F. H. Burke, San José	Sil. Med.
Sweepstakes.		
Mechthildus, best bull any age	F. H. Burke, San José	44 00
Queen of La Siesta, best cow any age	F. H. Burke, San José	4 00

First Department—Cattle—Continued.

Exhibit.	Exhibitor.	Award.
CLASS VII—JERSEYS.		
Bulls.		
Panwood of Y. B., best three years old and over	Henry Pierce, San Francisco	$30 00
Peter Shields, second best	Thomas Waite, Perkins	15 00
Mentone of Y. B., best two-year-old	Peter J. Shields, Sacramento	20 00
Fidelity of Y. B., second best	Henry Pierce, San Francisco	10 00
Napa Boy, best one-year-old	Thomas Waite, Perkins	15 00
El Bravo of Y. B., second best	Henry Pierce, San Francisco	7 50
Duke Onyx, best bull calf	C. V. Osborn, Elk Grove	10 00
San Luis of Y. B., second best	Henry Pierce, San Francisco	5 00
Cows.		
Oleta's Alphea, best three years old and over	Peter J. Shields, Sacramento	30 00
Camanite, second best	Peter J. Shields, Sacramento	15 00
Pedro's Prudence, best two-year-old	Peter J. Shields, Sacramento	20 00
Grau, second best	Thomas Waite, Perkins	10 00
Eye of Y. B., best one-year-old	Henry Pierce, San Francisco	15 00
Little Lucy, second best	Thomas Waite, Perkins	7 50
Lizette of Y. B., best heifer calf	Henry Pierce, San Francisco	10 00
El Nido of Y. B., second best	Henry Pierce, San Francisco	5 00
Herds.		
Mentone of Y. B. and four cows, best herd two years old and over	Peter J. Shields, Sacramento	40 00
Ogibway of Y. B. and four cows, best herd under two years	Henry Pierce, San Francisco	20 00
Toronto of Y. B. and four calves, best calf herd	Henry Pierce, San Francisco	Sil. Med.
Sweepstakes.		
Panwood of Y. B., best bull any age	Henry Pierce, San Francisco	52 00
Oleta's Alphea, best cow any age	Peter J. Shields, Sacramento	80 00
CLASS VIII—HERD SWEEPSTAKES FOR BEEF BREEDS.		
McCord and four cows, best herd	John Sparks, Reno, Nev.	90 00
CLASS IX—GRAND SWEEPSTAKES FOR BEEF BREEDS.		
Bulls.		
Sharon Victor VI, best three years old and over	Joseph Marzen, Lovelock, Nev.	36 00
The Grove I, best two-year-old	John Sparks, Reno, Nev.	2 00
Perfection II, best one-year-old	John Sparks, Reno, Nev.	18 00
Humboldt Victor XIII, best calf	Joseph Marzen, Lovelock, Nev.	1 00
Cows.		
Ida May, best three years old and over	John Sparks, Reno, Nev.	36 00
Pandora V, best two-year-old	John Sparks, Reno, Nev.	24 00
Phœbe Alamo, best one-year-old	John Sparks, Reno, Nev.	1 50
Fairview Alamo, best calf	John Sparks, Reno, Nev.	1 00
SPECIAL.		
Humboldt Victor, yearling bull	Jos. Marzen, Lovelock ..Hon. Men.	& Dip.
Duchess of Humboldt VIII, three-year-old cow	Jos. Marzen, Lovelock ..Hon. Men.	& Dip.

SHEEP.

Exhibit.	Exhibitor.	Award.
CLASS II—FRENCH MERINO.		
Best ram, two years old and over	J. H. Glide, Sacramento	$10 00
Best ram, one year old	J. H. Glide, Sacramento	7 50
Best three ram lambs	J. H. Glide, Sacramento	10 00
Best pen of five ewes, two years old	J. H. Glide, Sacramento	10 00
Best pen of five ewes, one year old	J. H. Glide, Sacramento	10 00
Best pen of five ewe lambs	J. H. Glide, Sacramento	10 00
Best ram and five of his lambs	J. H. Glide, Sacramento	10 00
CLASS VII—SHROPSHIRE.		
Best ram, any age	J. H. Glide, Sacramento	10 00
Best pen of five ewes	J. H. Glide, Sacramento	10 00
Best ram and five of his lambs	J. H. Glide, Sacramento	10 00
Best three ram lambs	J. H. Glide, Sacramento	7 50
Best pen of five ewe lambs	J. H. Glide, Sacramento	7 50
CLASS III—SOUTHDOWNS.		
Best ram, any age	George Bement, East Oakland	20 00
Second best	Thomas Waite, Perkins	10 00
Best pen of five ewes	Thomas Waite, Perkins	20 00
Second best	George Bement, East Oakland	10 00
Best ram and five of his lambs	George Bement, East Oakland	20 00
Second best	Thomas Waite, Perkins	10 00
CLASS IV—DORSET HORNS.		
Best ram, any age	S. B. Wright, Santa Rosa	10 00
Best pen of five ewes	S. B. Wright, Santa Rosa	10 00
CLASS V—PERSIAN.		
Best ram, any age	C. P. Bailey, San José	10 00
Best pen of five ewes	C. P. Bailey, San José	10 00
Best ram and five lambs	C. P. Bailey, San José	10 00
SWEEPSTAKES.		
Best French Merino ram and five of his lambs	J. H. Glide, Sacramento	2 00
Best Shropshire ram and five of his lambs	J. H. Glide, Sacramento	2 00

ANGORA GOATS.

THOROUGHBREDS.		
Best buck, two years old and over	C. P. Bailey, San José	$15 00
Second best	C. E. Bailey, San José	7 50
Best buck under two years	C. E. Bailey, San José	10 00
Second best	C. P. Bailey, San José	5 00
Best pen of three does, two years old and over	C. E. Bailey, San José	15 00
Second best	C. P. Bailey, San José	7 50
Best pen of three does, under two years	C. P. Bailey, San José	10 00
Second best	C. E. Bailey, San José	5 00
GRADED.		
Best pen of three, two years old and over	C. E. Bailey, San José	5 00
HERDS.		
Best herd of ten, any age or breed	C. P. Bailey, San José	25 00
Second best	C. E. Bailey, San José	10 00

SWINE.

Exhibit.	Exhibitor.	Award.
CLASS I—BERKSHIRE.		
Boars.		
Artful Lee, best two years old and over	S. B. Wright, Santa Rosa	$20 00
Columbus Duke, second best	Thomas Waite, Perkins	10 00
Star Baron, best one-year-old	S. B. Wright, Santa Rosa	15 00
Baron Lynwood, second best	Sessions & Co., Los Angeles	7 50
Baron Metcalf, best six months old	Sessions & Co., Los Angeles	10 00
Columbus Duke V, second best	S. B. Wright, Santa Rosa	5 00
Kingmaker II, best under six months	S. B. Wright, Santa Rosa	7 50
Lynwood Bachelor, second best	Sessions & Co., Los Angeles	5 00
Sows.		
Miss Platsburg III, best breeding sow two years old and over	S. B. Wright, Santa Rosa	20 00
Moline, second best	Chas. C. Perkins, Sacramento	10 00
Lady Gentry, best one year old and under two	Thomas Waite, Perkins	15 00
Miss Platsburg VIII, second best	S. B. Wright, Santa Rosa	7 50
Rose W., best six months old and under one year	Thomas Waite, Perkins	10 00
Artful Empress, second best	S. B. Wright, Santa Rosa	5 00
Lynwood Belle, best under six months	Sessions & Co., Los Angeles	7 50
Los Angeles II, second best	S. B. Wright, Santa Rosa	5 00
Miss Platsburg and four pigs, best sow and four pigs under six months	S. B. Wright, Santa Rosa	20 00
Cora Metcalf and six pigs, second best	Sessions & Co., Los Angeles	10 00
Sweepstakes.		
Star Baron, best boar any age	S. B. Wright, Santa Rosa	28 00
Miss Platsburg III, best sow any age	S. B. Wright, Santa Rosa	26 00
Artful Lee and three sows, best boar and three sows over one year	S. B. Wright, Santa Rosa	24 00
Best four swine, get of one boar	S. B. Wright, Santa Rosa	2 00
Best pen of six pigs under six months	S. B. Wright, Santa Rosa	18 00
CLASS II—ESSEX.		
Boars.		
Ohio Major, best two years old and over	George Bement, East Oakland	10 00
——, best six months old	George Bement, East Oakland	5 00
——, best under six months	George Bement, East Oakland	5 00
Sows.		
Black Bessie, best two years old and over	George Bement, East Oakland	10 00
Squallor, best one-year-old	George Bement, East Oakland	7 50
Victoria, best six months old	George Bement, East Oakland	5 00
Lady Maud, best under six months	George Bement, East Oakland	5 00
California Duchess and four pigs, best sow and four pigs	George Bement, East Oakland	10 00
Sweepstakes.		
Ohio Major, best boar any age	George Bement, East Oakland	2 00
Squallor, best sow any age	George Bement, East Oakland	4 00
Ohio Major and three sows, best boar and three sows	George Bement, East Oakland	2 00
Best four swine, the get of one boar	George Bement, East Oakland	2 00
Best pen of six pigs, under six months	George Bement, East Oakland	1 50
CLASS III—POLAND-CHINA.		
Boars.		
Tecumseh Perfection, best two years old and over	S. P. Lindgren & Sons, Kingsburg	20 00
Buckeye Boy, second best	W. R. McCaslin, El Monte	10 00
Chief Perfection V, best one-year-old	S. P. Lindgren & Sons, Kingsburg	15 00
Ideal Chief, second best	Sessions & Co., Los Angeles	7 50
Gold Sun, best six months old	Sessions & Co., Los Angeles	10 00
Best Tecumseh, second best	S. P. Lindgren & Sons, Kingsburg	5 00
——, best under six months	S. P. Lindgren & Sons, Kingsburg	7 50
——, second best	Sessions & Co., Los Angeles	5 00

First Department—Swine—Continued.

Exhibit.	Exhibitor.	Award.
Sows.		
Midnight, best two years old and over	W. R. McCaslin, El Monte	$20 00
Lynmont Queen, second best	Sessions & Co., Los Angeles	10 00
Iowa Sunrise, best one-year-old	S. P. Lindgren & Sons, Kingsburg	15 00
Grand Tecumseh, second best	S. P. Lindgren & Sons, Kingsburg	7 50
Little Inez, best six months old	Sessions & Co., Los Angeles	10 00
Wilkes Tecumseh, second best	S. P. Lindgren & Sons, Kingsburg	5 00
——, best sow pig under six months	S. P. Lindgren & Sons, Kingsburg	7 50
——, second best	Sessions & Co., Los Angeles	5 00
Best of 1900 and four pigs, best sow and four pigs	S. P. Lindgren & Sons, Kingsburg	20 00
Black Maud and four pigs, second best	W. R. McCaslin, El Monte	10 00
Sweepstakes.		
Chief Perfection IV, best boar any age	S. P. Lindgren & Sons, Kingsburg	24 00
Midnight, best sow any age	W. R. McCaslin, El Monte	32 00
Ideal Chief and three sows, best boar and three sows over one year	Sessions & Co., Los Angeles	26 00
Best four swine	S. P. Lindgren & Sons, Kingsburg	24 00
Best pen of six pigs	S. P. Lindgren & Sons, Kingsburg	24 00

POULTRY.

LIGHT BRAHMAS.		
Best breeding pen	F. Forbes, Napa	$5 00
Second best	F. Forbes, Napa	3 50
Best cock	F. Forbes, Napa	1 50
Third best	Mrs. F. H. Snow, San José	50
Best hen	F. Forbes, Napa	1 50
Best cockerel	F. Forbes, Napa	1 50
Best pullet	F. Forbes, Napa	1 50
Second best	Mrs. F. H. Snow, San José	1 00
DARK BRAHMAS.		
Second best breeding pen	Mrs. F. H. Snow, San José	3 50
Second best pullet	Mrs. F. H. Snow, San José	1 00
Third best	Mrs. F. H. Snow, San José	50
BLACK COCHINS.		
Best breeding pen	T. B. C. Sielcken, Calistoga	5 00
Second best cock	T. B. C. Sielcken, Calistoga	1 00
WHITE COCHINS.		
Best cock	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best cockerel	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Best pullet	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
BUFF COCHINS.		
Best breeding pen	Santa Teresa Farm, Edenvale	5 00
Second best	T. B. C. Sielcken, Calistoga	3 50
Third best	Duncan Robertson, Alameda	1 50
Best cock	T. B. C. Sielcken, Calistoga	1 50
Second best	Santa Teresa Farm, Edenvale	1 00
Third best	Santa Teresa Farm, Edenvale	50
Best hen	Duncan Robertson, Alameda	1 50
Second best	Duncan Robertson, Alameda	1 00
Third best	Duncan Robertson, Alameda	50
Best cockerel	Santa Teresa Farm, Edenvale	1 50
Second best	Duncan Robertson, Alameda	1 00
Third best	Duncan Robertson, Alameda	50
Best pullet	T. B. C. Sielcken, Calistoga	1 50
Second best	Duncan Robertson, Alameda	1 50
Third best	Duncan Robertson, Alameda	50

First Department—Poultry—Continued.

Exhibit.	Exhibitor.	Award.
PARTRIDGE COCHINS.		
Best cock	T. B. Sielcken, Calistoga	$1 50
Second best	W. P. Lyon, Edenvale	1 00
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	W. P. Lyon, Edenvale	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Third best cockerel	T. B. C. Sielcken, Calistoga	50
Best pullet	W. P. Lyon, Edenvale	1 50
Third best	T. B. C. Sielcken, Calistoga	50
BLACK LANGSHANS.		
Best breeding pen	F. P. Lowell, Oakland	5 00
Best cock	T. B. C. Sielcken, Calistoga	1 50
Second best	F. P. Lowell, Oakland	1 00
Best hen	F. P. Lowell, Oakland	1 50
Second best	F. P. Lowell, Oakland	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best cockerel	F. P. Lowell, Oakland	1 50
Second best	F. P. Lowell, Oakland	1 50
Best pullet	F. P. Lowell, Oakland	1 50
Second best	F. P. Lowell, Oakland	1 00
Third best	F. P. Lowell, Oakland	50
WHITE LANGSHANS.		
Best cock	T. B. C. Sielcken, Calistoga	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Best hen	T. B. C. Sielcken, Calistoga	1 50
BARRED PLYMOUTH ROCKS.		
Best breeding pen	E. J. Boden, Sacramento	5 00
Second best	F. Forbes, Napa	3 50
Third best	H. A. Loud, Vacaville	1 50
Best cock	F. Forbes, Napa	1 50
Best hen	E. J. Boden, Sacramento	1 50
Second best	E. J. Boden, Sacramento	1 00
Third best	E. J. Boden, Sacramento	50
Best cockerel	F. Forbes, Napa	1 50
Second best	Santa Teresa Farm, Edenvale	1 00
Third best	Coffey Bros., Sacramento	50
Best pullet	E. J. Boden, Sacramento	1 50
Second best	E. J. Boden, Sacramento	1 00
Third best	E. J. Boden, Sacramento	50
WHITE PLYMOUTH ROCKS.		
Best breeding pen	W. A. Gilbert, Sacramento	5 00
Second best	Coffey Bros., Sacramento	3 50
Best cock	T. B. C. Sielcken, Calistoga	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Best hen	Coffey Bros., Sacramento	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Best cockerel	W. A. Gilbert, Sacramento	1 50
Best pullet	W. A. Gilbert, Sacramento	1 50
Second best	Coffey Bros., Sacramento	1 00
Third best	Coffey Bros., Sacramento	50
BUFF PLYMOUTH ROCKS.		
Best breeding pen	T. B. C. Sielcken, Calistoga	5 00
Best cock	Mrs. F. H. Snow, San José	1 50
Best hen	Mrs. F. H. Snow, San José	1 50
BROWN LEGHORNS.		
Best breeding pen	S. P. Lindgren & Sons, Kingsburg	5 00
Second best	J. R. Catlett, Pleasant Grove	3 50
Third best	Coffey Bros., Sacramento	1 50
Best cock	S. P. Lindgren & Sons, Kingsburg	1 50
Second best	Coffey Bros., Sacramento	1 00
Third best	Coffey Bros., Sacramento	50
Best hen	J. R. Catlett, Pleasant Grove	1 50
Second best	J. R. Catlett, Pleasant Grove	1 00
Third best	Coffey Bros., Sacramento	50

FIRST DEPARTMENT—POULTRY—Continued.

Exhibit.	Exhibitor.	Award.
BROWN LEGHORNS—*Continued.*		
Best cockerel	Santa Teresa Farm, Edenvale	$1 50
Second best	Santa Teresa Farm, Edenvale	1 00
Third best	S. P. Lindgren & Sons, Kingsburg	50
Best pullet	J. R. Catlett, Pleasant Grove	1 50
Second best	J. R. Catlett, Pleasant Grove	1 00
Third best	J. R. Caclett, Pleasant Grove	50
BROWN LEGHORNS—ROSE COMB.		
Best breeding pen	T. B. C. Sielcken, Calistoga	5 00
Best cock	T. B. C. Sielcken, Calistoga	1 50
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
WHITE LEGHORNS—ROSE COMB.		
Best breeding pen	T. B. C. Sielcken, Calistoga	5 00
Second best	T. B. C. Sielcken, Calistoga	3 50
Best cock	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Best cockerel	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best pullet	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	T. B. C. Sielcken, Calistoga	50
WHITE LEGHORNS.		
Best breeding pen	Santa Teresa Farm, Edenvale	5 00
Second best	J. F. Sarmento, San Leandro	3 50
Third best	J. A. Catlett, Pleasant Grove	1 50
Best cock	J. F. Sarmento, San Leandro	1 50
Second best	Santa Teresa Farm, Edenvale	1 00
Third best	Coffey Bros., Sacramento	50
Best hen	W. P. Lyon, Edenvale	1 50
Second best	J. F. Sarmento, San Leandro	1 00
Third best	J. F. Sarmento, San Leandro	50
Best cockerel	J. F. Sarmento, San Leandro	1 50
Second best	Coffey Bros., Sacramento	1 00
Third best	Uhl's Poultry Yard, Sacramento	50
Best pullet	W. P. Lyon, Edenvale	1 50
Second best	J. F. Sarmento, San Leandro	1 00
Third best	J. A. Catlett, Pleasant Grove	50
BUFF LEGHORNS.		
Best breeding pen	S. P. Lindgren & Sons, Kingsburg	5 00
Best cock	J. F. Sarmento, San Leandro	1 50
Second best	J. F. Sarmento, San Leandro	1 00
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	J. F. Sarmento, San Leandro	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best cockerel	T. B. C. Sielcken, Calistoga	1 50
Second best	J. F. Sarmento, San Leandro	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best pullet	S. P. Lindgren & Sons, Kingsburg	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	J. F. Sarmento, San Leandro	50
WHITE MINORCAS.		
Best breeding pen	T. B. C. Sielcken, Calistoga	5 00
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best pullet	T. B. C. Sielcken, Calistoga	1 50

First Department—Poultry—Continued.

Exhibit.	Exhibitor.	Award.
BLACK MINORCAS.		
Best breeding pen	Santa Teresa Farm, Edenvale	$5 00
Second best	Wm. A. French, Stockton	3 50
Third best	S. P. Lindgren & Sons, Kingsburg	1 50
Best cock	Santa Teresa Farm, Edenvale	1 50
Second best	W. S. Childs, Oakland	1 00
Third best	Santa Teresa Farm, Edenvale	50
Best hen	W. S. Childs, Oakland	1 50
Second best	W. S. Childs, Oakland	1 00
Third best	S. P. Lindgren & Sons, Kingsburg	50
Best cockerel	W. S. Childs, Oakland	1 50
Second best	Wm. A. French, Stockton	1 00
Third best	S. P. Lindgren & Sons, Kingsburg	50
Best pullet	W. S. Childs, Oakland	1 50
Second best	W. S. Childs, Oakland	1 00
Third best	S. P. Lindgren & Sons, Kingsburg	50
ANDALUSIANS.		
Best breeding pen	Wm. A. French, Stockton	5 00
Best cock	Wm. A. French, Stockton	1 50
Best hen	Wm. A. French, Stockton	1 50
Best pullet	Wm. A. French, Stockton	1 50
SILVER WYANDOTTES.		
Best breeding pen	Coffey Bros., Sacramento	5 00
Second best	Coffey Bros., Sacramento	3 50
Best cock	Coffey Bros., Sacramento	1 50
Second best	Coffey Bros., Sacramento	1 00
Third best	Coffey Bros., Sacramento	50
Best hen	Coffey Bros., Sacramento	1 50
Best cockerel	Coffey Bros., Sacramento	1 50
Best pullet	Coffey Bros., Sacramento	1 50
Second best	Coffey Bros., Sacramento	1 00
Third best	Coffey Bros., Sacramento	50
GOLDEN WYANDOTTES.		
Best cock	Coffey Bros., Sacramento	1 50
Best hen	Coffey Bros., Sacramento	1 50
Second best	Coffey Bros., Sacramento	1 00
Third best	Coffey Bros., Sacramento	50
Best cockerel	Coffey Bros., Sacramento	1 50
Second best	Coffey Bros., Sacramento	1 00
Third best	Coffey Bros., Sacramento	50
WHITE WYANDOTTES.		
Best breeding pen	F. Forbes, Napa	5 00
Second best	Santa Teresa Farm, Edenvale	3 50
Third best	F. Forbes, Napa	1 50
Best cock	T. B. C. Sielcken, Calistoga	1 50
Second best	F. Forbes, Napa	1 00
Third best	Santa Teresa Farm, Edenvale	50
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best cockerel	T. B. C. Sielcken, Calistoga	1 50
Second best	F. Forbes, Napa	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best pullet	Santa Teresa Farm, Edenvale	1 50
Second best	Santa Teresa Farm, Edenvale	1 00
Third best	Santa Teresa Farm, Edenvale	50
POLISH.		
Best breeding pen	Mrs. F. H. Snow, San José	5 00
Best cock	Mrs. F. H. Snow, San José	1 50
Best hen	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Third best	Mrs. F. H. Snow, San José	50
Best cockerel	Mrs. F. H. Snow, San José	1 50
Second best pullet	Mrs. F. H. Snow, San José	1 00

First Department—Poultry—Continued.

Exhibit.	Exhibitor.	Award.
SILVER-SPANGLED HAMBURGS.		
Best breeding pen	Mrs. F. H. Snow, San José	$5 00
Best cock	Mrs. F. H. Snow, San José	1 50
Best cockerel	Mrs. F. H. Snow, San José	1 50
Best pullet	Mrs. F. H. Snow, San José	1 50
BUFF COCHIN BANTAMS.		
Best breeding pen	Mrs. F. H. Snow, San José	5 00
Second best cock	Mrs. F. H. Snow, San José	1 00
Second best cockerel	Mrs. F. H. Snow, San José	1 00
Second best pullet	Mrs. F. H. Snow, San José	1 00
GOLDEN DUCKWING BANTAMS.		
Best breeding pen	Mrs. F. H. Snow, San José	5 00
Best cock	Mrs. F. H. Snow, San José	1 50
Best hen	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Best cockerel	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Best pullet	Mrs. F. H. Snow, San José	1 50
GOLDEN SEBRIGHT BANTAMS.		
Best breeding pen	Santa Teresa Farm, Edenvale	5 00
Second best	Mrs. F. H. Snow, San José	3 50
Best cock	Santa Teresa Farm, Edenvale	1 50
Second best	Santa Teresa Farm, Edenvale	1 00
Third best	Santa Teresa Farm, Edenvale	50
Best hen	Santa Teresa Farm, Edenvale	1 50
Second best	Santa Teresa Farm, Edenvale	1 00
Third best	Santa Teresa Farm, Edenvale	50
Best cockerel	George B. Nugent, San José	1 50
Second best	George B. Nugent, San José	1 00
Third best	Mrs. F. H. Snow, San José	50
Best pullet	Mrs. F. H. Snow, San José	1 50
SILVER SEBRIGHT BANTAMS.		
Best hen	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Third best	Mrs. F. H. Snow, San José	50
BLACK-BREASTED RED GAME BANTAMS.		
Best breeding pen	Mrs. F. H. Snow, San José	5 00
Best cock	Coffey Bros., Sacramento	1 50
Best hen	Coffey Bros., Sacramento	1 50
Second best	Coffey Bros., Sacramento	1 00
Best cockerel	Coffey Bros., Sacramento	1 50
Second best	Coffey Bros., Sacramento	1 00
Best pullet	Coffey Bros., Sacramento	1 50
Second best	Coffey Bros., Sacramento	1 00
CORNISH INDIAN GAMES.		
Best breeding pen	Percy Ward, Burson	5 00
Second best	Mrs. F. H. Snow, San José	3 50
Best cock	Mrs. F. H. Snow, San José	1 50
Best hen	Percy Ward, Burson	2 00
Second best	Mrs. F. H. Snow, San José	1 00
Third best	Mrs. F. H. Snow, San José	50
Best cockerel	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
Best pullet	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
HOUDANS.		
Best breeding pen	W. P. Lyon, Edenvale	5 00
Second best	W. P. Lyon, Edenvale	3 50
Best cock	W. P. Lyon, Edenvale	1 50
Second best	W. P. Lyon, Edenvale	1 00
Third best	W. P. Lyon, Edenvale	50
Best hen	W. P. Lyon, Edenvale	1 50
Second best	W. P. Lyon, Edenvale	1 00

FIRST DEPARTMENT—POULTRY—Continued.

Exhibit.	Exhibitor.	Award.
HOUDANS—*Continued.*		
Third best hen	W. P. Lyon, Edenvale	$0 50
Best cockerel	W. P. Lyon, Edenvale	1 50
Second best	W. P. Lyon, Edenvale	1 00
Third best	W. P. Lyon, Edenvale	50
Best pullet	W. P. Lyon, Edenvale	1 50
Second best	W. P. Lyon, Edenvale	1 00
Third best	W. P. Lyon, Edenvale	50
MOTTLED LANGSHANS.		
Best breeding pen	Mrs. F. H. Snow, San José	5 00
Best cockerel	Mrs. F. H. Snow, San José	1 50
Best pullet	Mrs. F. H. Snow, San José	1 50
Second best	Mrs. F. H. Snow, San José	1 00
PEARL GUINEAS.		
Best pair	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
BLACK SPANISH.		
Best hen	S. P. Lindgren & Sons, Kingsburg	1 50
Second best	S. P. Lindgren & Sons, Kingsbnrg	1 00
WHITE GUINEAS.		
Best pair	William A. French, Stockton	1 50
BLACK BANTAMS—ROSE COMB.		
Best cock	T. B. C. Sielcken, Calistoga	1 50
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Best cockerel	T. B. C. Sielcken, Calistoga	1 50
Best pullet	T. B. C. Sielcken, Calistoga	1 50
BUFF COCHIN BANTAMS.		
Best cock	T. B. C. Sielcken, Calistoga	1 50
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Best cockerel	George B. Nugent, San José	1 50
Best pullet	T. B. C. Sielcken, Calistoga	1 50
BLACK COCHIN BANTAMS.		
Best breeding pen	George B. Nugent, San José	5 00
Best cock	T. B. C. Sielcken, Calistoga	1 50
Best hen	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best cockerel	Duncan Robertson, Alameda	1 50
Best pullet	T. B. C. Sielcken, Calistoga	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Third best	T. B. C. Sielcken, Calistoga	50
WHITE COCHIN BANTAMS.		
Best breeding pen	Duncan Robertson, Alameda	5 00
Best cock	Santa Teresa Farm, Edenvale	1 50
Second best	George B. Nugent, San José	1 00
Third best	T. B. C. Sielcken, Calistoga	50
Best hen	George B. Nugent, San José	1 50
Second best	T. B. C. Sielcken, Calistoga	1 00
Best cockerel	George B. Nugent, San José	1 50
Second best	George B. Nugent, San José	1 00
Third best	George B. Nugent, San José	50
Best pullet	Duncan Robertson, Alameda	1 50
Second best	George B. Nugent, San José	1 00
Third best	George B. Nugent, San José	50

First Department—Poultry—Continued.

Exhibit.	Exhibitor.	Award.
ORPINGTONS.		
Best cock	J. R. Riddell, Fresno	$1 50
Second best	J. R. Riddell, Fresno	1 00
Third best	J. R. Riddell, Fresno	50
Best hen	J. R. Riddell, Fresno	1 50
Second best	J. R. Riddell, Fresno	1 00
Third best	J. R. Riddell, Fresno	50
Best pullet	J. R. Riddell, Fresno	1 50
Second best	J. R. Riddell, Fresno	1 00
Third best	J. R. Riddell, Fresno	50
Best cockerel	J. R. Riddell, Fresno	1 50
Second best	J. R. Riddell, Fresno	1 00
SWEEPSTAKES.		
For the largest and best exhibit of fowl, by one exhibitor, American varieties	Coffey Bros., Sacramento	10 00
For the largest and best exhibit of fowl, by one exhibitor, Asiatic varieties	T. B. C. Sielcken, Calistoga	10 00
For the largest and best exhibit of fowl, by one exhibitor, Mediterranean varieties	T. B. C. Sielcken, Calistoga	10 00
WHITE HOLLAND TURKEYS.		
Best pair	T. B. C. Sielcken, Calistoga	4 00
BRONZE TURKEYS.		
Best pair	J. R. Catlett, Pleasant Grove	8 00
Second best	Wm. A. French, Stockton	5 00
Third best	J. R. Catlett, Pleasant Grove	2 00
NARRAGANSETT TURKEYS.		
Best pair	Wm. A. French, Stockton	8 00
Second best	J. R. Catlett, Pleasant Grove	5 00
GEESE.		
Best pair Toulouse geese	T. B. C. Sielcken, Calistoga	4 00
Second best	T. B. C. Sielcken, Calistoga	2 50
Third best	J. R. Catlett, Pleasant Grove	1 50
Best pair Emden geese	T. B. C. Sielcken, Calistoga	4 00
Second best	T. B. C. Sielcken, Calistoga	2 50
Third best	T. B. C. Sielcken, Calistoga	1 50
DUCKS.		
Best pair Pekin ducks	T. B. C. Sielcken, Calistoga	4 00
Second best	T. B. C. Sielcken, Calistoga	2 50
Best pair Pekin ducks under six months	J. R. Catlett, Pleasant Grove	2 00
Second best	Fair Oaks Duck Farm, Oakland	1 00
Best pair Rouen ducks	W. S. Childs, Oakland	4 00
Best pair Black Cayuga ducks	Fair Oaks Duck Farm, Oakland	4 00
Best pair Grey Call ducks	Fair Oaks Duck Farm, Oakland	4 00
Best pair Muscovy ducks	W. S. Childs, Oakland	4 00
Second best	W. S. Childs, Oakland	2 50
Best pair Indian Runner ducks	W. S. Childs, Oakland	4 00
Second best	Fair Oaks Duck Farm, Oakland	2 50
Best pair Indian Runner ducks under six months	W. S. Childs, Oakland	2 00
Second best	W. S. Childs, Oakland	1 00

Amount of awards in First Department—Livestock other than poultry	$3,867 00
Amount of awards in poultry section	622 00
Total	$4,489 00

SECOND DEPARTMENT.

MACHINERY, IMPLEMENTS, ETC.

Exhibit.	Exhibitor.	Award.
CLASS I—MACHINERY, ENGINES, ETC.		
Best spray pump for orchards	Bean Spray Pump Co., Los Gatos	$20 00
Best display of machinery from one shop or manufactory	Baker & Hamilton, Sacramento	25 00
Best apparatus for raising water for irrigation purposes, not less than 500 gallons per minute	Holbrook, Merrill & Stetson, Sac.	10 00
Best well pump	Holbrook, Merrill & Stetson, Sac.	10 00
CLASS II—AGRICULTURAL MACHINES—FIRST DIVISION.		
Best cider mill and press	Thomson-Diggs Co., Sacramento	1 00
Best horse hay rake	Thomson-Diggs Co., Sacramento	1 00
Best hay and straw cutter	Thomson-Diggs Co., Sacramento	1 00
Best display of agricultural machinery by any one house, California manufacture	Benicia Agricultural Works	20 00
Best sweep horse-power, California manufacture	Benicia Agricultural Works	5 00
Best hay press	Baker & Hamilton, Sacramento	1 00
Best lawn sprinkler	Holbrook, Merrill & Stetson, Sac.	1 00
Best gopher trap	The A. S. Hopkins Co., Sac'to	1 00
CLASS III—AGRICULTURAL MACHINES—SECOND DIVISION.		
Best improved beet cultivator	S. L. Allen & Co., San Francisco	5 00
Best one-horse cultivator	S. L. Allen & Co., San Francisco	5 00
Best cultivator	S. L. Allen & Co., San Francisco	5 00
Best potato digger	Thomson-Diggs Co., Sacramento	1 00
Best harrow	Thomson-Diggs Co., Sacramento	Diploma.
Best disk harrow	Thomson-Diggs Co., Sacramento	$5 00
Best broadcast sowing machine	Benicia Agricultural Works	5 00
Best self-raking reaping machine	Baker & Hamilton, Sacramento	1 00
Best mowing machine	Baker & Hamilton, Sacramento	5 00
Best wheat drill	Baker & Hamilton, Sacramento	10 00
Best self-binding harvester	Baker & Hamilton, Sacramento	5 00
Best potato planter	Ennis-Brown Co., Sacramento	Diploma.
CLASS IV—AGRICULTURAL MACHINES—THIRD DIVISION.		
Best wire park or paddock fence	American Steel and Wire Co., S. F.	Diploma.
Best wire stock fence	American Steel and Wire Co., S. F.	Diploma.
Best farm gate	American Steel and Wire Co., S. F.	Sil. Med.
Best wire-fence stretcher	American Steel and Wire Co., S. F.	Diploma.
Best ornamental fence	American Steel and Wire Co., S. F.	Diploma.
Best beehives, without bees	The A. S. Hopkins Co., Sac'to	Diploma.
Best fanning mill	Thomson-Diggs Co., Sacramento	$1 00
Best windmill	Holbrook, Merrill & Stetson, Sac.	10 00
Best agricultural boiler	Hendy Machine Works, San Fran.	1 00
Best platform scales	G. G. Wickson & Co., San Fran.	2 00
CLASS V—TOOLS AND HOUSEHOLD IMPLEMENTS.		
Best garden seed drill	S. L. Allen & Co., San Francisco	Diploma.
Best clothes horse	J. J. Stephenson, Winters	Diploma.
Best cabbage cutter	The A. S. Hopkins Co., Sac'to	$2 00
Best washing machine	The A. S. Hopkins Co., Sac'to	Diploma.
Best egg carrier	The A. S. Hopkins Co., Sac'to	Sil. Med.
Best road scraper	Thomson-Diggs Co., Sacramento	$5 00
Best excavating scraper	Thomson-Diggs Co., Sacramento	5 00
Best display of haying and harvesting tools	Baker & Hamilton, Sacramento	10 00
Best sausage-meat cutter and stuffer	Baker & Hamilton, Sacramento	2 00
Best clingstone pitter	G. G. Wickson & Co., San Fran.	5 00

Second Department—Machinery, Etc.—Continued.

Exhibit.	Exhibitor.	Award.
CLASS VI—PLOWS.		
Best road plow	Thomson-Diggs Co., Sacramento	$5 00
Best two- or three-horse plow	Thomson-Diggs Co., Sacramento	5 00
Best sidehill plow	Thomson-Diggs Co., Sacramento	5 00
Best gang plow	Benicia Agricultural Works	5 00
Best sulky plow	Benicia Agricultural Works	5 00
Best subsoil plow	Benicia Agricultural Works	5 00
Best vineyard plow	Benicia Agricultural Works	5 00
CLASS VII—VEHICLES.		
Best closed family carriage	A. Meister & Sons Co., Sac'to	Sil. Med.
Best top buggy	A. Meister & Sons Co., Sac'to	$10 00
Best open buggy	A. Meister & Sons Co., Sac'to	10 00
Best single seat trotting wagon	A. Meister & Sons Co., Sac'to	10 00
Best trap or ladies' phaeton	A. Meister & Sons Co., Sac'to	10 00
Best farm wagon for general purposes, wood or iron	Baker & Hamilton, Sacramento	10 00
Best open family carriage	Schaw, Ingram, Batcher & Co., Sac.	Sil. Med.
Best two-seat open wagon	Schaw, Ingram, Batcher & Co., Sac.	$10 00
Best business wagon	Schaw, Ingram, Batcher & Co., Sac.	10 00
Farm wagon for general purposes	Gene Rey, Maxwell	Diploma.
CLASS VIII—MISCELLANEOUS.		
Best farm and orchard truck	J. A. Ashley, Winters	Diploma.
Best vehicle in white	A. Meister & Sons Co., Sac'to	Diploma.
Best disk gang plow	Thomson-Diggs Co., Sacramento	Diploma.
Best header	Baker & Hamilton, Sacramento	$1 00
Best oil-well machinery in operation	The R. H. Herron Co., Los Angeles	Sil. Med.
For a complete miniature oil pumping plant	Mount Hamilton Land and Oil Co., Coalinga	Diploma.
For "Wise" wood splitter	I. A. Coonradt & Son, Oakland	Diploma.
For best sprinkling wagon	Schaw, Ingram, Batcher & Co., Sac.	Diploma.
Best glass fruit jars	Mrs. E. A. Bray, Los Gatos.	Diploma.
Best automatic side hill fruit ladder	J. J. Howard, San Francisco	Sil. Med.
Best potato cutter	Ennis-Brown Co., Sacramento	Diploma.
Best self-feed ensilage cutter	Thomson-Diggs Co., Sacramento	$1 00
Best side hill gang plow	M. C. Dethlefs, Willows	Diploma.
Best Century steam automobile	Sunset Automobile Co., San Fran.	Sil. Med.
Best Century electric automobile	Sunset Automobile Co., San Fran.	Diploma.
Best Sunset steam automobile	Sunset Automobile Co., San Fran.	Diploma.

Total amount of cash awards in Second Department $298 00

THIRD DEPARTMENT.

TEXTILE FABRICS, AND THE MATERIALS FROM WHICH THEY ARE MADE.

Exhibit.	Exhibitor.	Award.
CLASS I—CLOTHING AND KINDRED TEXTURES.		
Best knitted shawl	Mrs. S. H. Hastings, Sacramento	$3 00
Best collection of furs, not less than six pieces	Hale Bros. & Co., Sacramento	5 00
Best display of dry goods	Hale Bros. & Co., Sacramento	20 00
Best display of fancy goods	Hale Bros. & Co., Sacramento	10 00
Best exhibit of carpets and rugs	C. M. Campbell, Sacramento	7 50
Best Turkish rug	C. M. Campbell, Sacramento	5 00

Third Department—Textile Fabrics—Continued.

Exhibit.	Exhibitor.	Award.
CLASS II—NEEDLE AND FANCY WORK AND DECORATIVE PAINTING.		
Best display of knit lace by hand	Miss Lucy Barter, Penryn	$5 00
Best embroidered infant's pillow	Mrs. A. Adams, Stockton	3 00
Best embroidered tea cloth	Mrs. A. Adams, Stockton	3 00
Largest and finest display of silk embroidery on linen	Mrs. A. Adams, Stockton	10 00
Best embroidered sideboard cover	Mrs. A. Adams, Stockton	3 00
Best Renaissance embroidery in rope silk	Mrs. A. Adams, Stockton	3 00
Best toilet set embroidered in silk	Mrs. A. Adams, Stockton	5 00
Best embroidered necktie case	Mrs. A. Adams, Stockton	2 00
Best Queen Anne embroidery	Mrs. A. Adams, Stockton	3 00
Best combination of tinting and embroidery	Mrs. A. Adams, Stockton	3 00
Best Empire style of embroidery	Mrs. A. Adams, Stockton	3 00
Best delft blue centerpiece	Mrs. A. Adams, Stockton	3 00
Best embroidered round centerpiece	Mrs. A. Adams, Stockton	3 00
Best crazy patchwork quilt	Mrs. Ella Sheldon, Sisson	3 00
Best embroidered table cover, all over	Mrs. Theodore Deming, Sac'to	3 00
Best embroidered piano scarf	Mrs. Theodore Deming, Sac'to	2 00
Best embroidered ottoman cover	Mrs. Theodore Deming, Sac'to	2 00
Best embroidered round centerpiece and doilies	Mrs. Theodore Deming, Sac'to	3 00
Best patchwork quilt	Miss A. M. Wilcox, Sacramento	3 00
Best hand sewing, not less than three pieces	Mrs. S. J. Hastings, Sacramento	2 00
Best embroidered tray cloth	Mrs. S. J. Hastings, Sacramento	3 00
Largest and finest display of outline embroidery	Mrs. S. J. Hastings, Sacramento	2 00
Best embroidered toilet set on linen	Mrs. S. J. Hastings, Sacramento	3 00
Best embroidery on silk	Mrs. S. J. Hastings, Sacramento	2 00
Best set of embroidered napkins or doilies	Mrs. S. J. Hastings, Sacramento	3 00
Best white cotton embroidery on linen	Mrs. S. J. Hastings, Sacramento	5 00
Best display of embroidered picture frames	Mrs. S. J. Hastings, Sacramento	5 00
Best display of pyrography, or burnt wood etching	Mrs. T. H. Wood, Suisun	5 00
Best single piece, burnt leather work	Mrs. B. Muddox, Sacramento	3 00
Second best	Mrs. B. Muddox, Sacramento	2 00
Best panel, burnt wood etching	Mrs. B. Muddox, Sacramento	2 00
Best display of ladies' underwear	Mrs. F. P. Jackson, Sacramento	10 00
Best embroidery	Mrs. F. P. Jackson, Sacramento	3 00
Best course service	Mrs. G. B. Carr, Sacramento	5 00
Best figure piece	Mrs. G. B. Carr, Sacramento	3 00
Best flower piece	Mrs. G. B. Carr, Sacramento	2 00
Best fruit piece	Mrs. G. B. Carr, Sacramento	2 00
Best jardiniere or bowl	Mrs. G. B. Carr, Sacramento	2 00
Best vase or piece of bric-a-brac	Mrs. G. B. Carr, Sacramento	2 00
Best set of plates, not less than six	Mrs. G. B. Carr, Sacramento	5 00
Best tea, coffee, or chocolate set	Mrs. G. B. Carr, Sacramento	5 00
Best tray or large plate	Mrs. G. B. Carr, Sacramento	2 00
Best, largest, and handsomest display of decorative painting	Mrs. G. B. Carr, Sacramento	20 00
Best velvet bonnet	Hale Bros. & Co., Sacramento	5 00
Best ladies' hat	Hale Bros. & Co., Sacramento	5 00
Best display of millinery	Hale Bros. & Co., Sacramento	2 00
Best display of feathers	Hale Bros. & Co., Sacramento	1 00
Best single piece	Miss E. Kennedy, San Francisco	3 00
Best set of cups and saucers, not less than six	Miss E. Kennedy, San Francisco	5 00
Best cracker or rose bowl	Miss E. Kennedy, San Francisco	2 00
Best single piece in delft decoration	Miss E. Kennedy, San Francisco	3 00
Best display of crochet lace	Miss V. H. Blacklock, Denverton	3 00
Best silk embroidery screens, black wood frame	F. Ukiah, Sacramento	Sil. Med.
Best silk embroidery bedspread	F. Ukiah, Sacramento	3 00
Best wood carving	H. A. Bristol, Willows	3 00

Third Department—Textile Fabrics—Continued.

Exhibit.	Exhibitor.	Award
CLASS II—PROFESSIONALS.		
Best, largest, and handsomest display of embroidered or hand-painted sofa pillows	Mrs. E. Adams, Los Angeles	$8 00
Best hand-made lace display—Honiton point lace and Battenburg	Mrs. T. H. Wood, Suisun City	12 00
Best Battenburg bedspread	Mrs. T. H. Wood, Suisun City	3 75
Best display of hand-made lace handkerchiefs	Mrs. T. H. Wood, Suisun City	7 50
Best Battenburg curtain	Mrs. F. P. Jackson, Sacramento	7 50
Best Battenburg centerpiece	Mrs. F. P. Jackson, Sacramento	4 00
CLASS II—AMATEURS.		
Best display of hand-made lace handkerchiefs	Miss Lucy Barter, Penryn	5 00
Best Battenburg curtain	Mrs. H. M. LaRue, Sacramento	5 00
Best, largest, and handsomest display of embroidered or hand-painted sofa cushions	Mrs. Theodore Deming, Sac'to	7 50
Best display of drawnwork	Mrs. Ross Guill, Chico	5 00
Best hand-made lace display—Battenburg and Honiton point lace	Miss Margaret A. Erhart, Sac'to	10 00
MISCELLANEOUS—PROFESSIONAL.		
Best pair of crazy patchwork pillowshams	Mrs. Ella Sheldon, Sisson	Diploma.
Best silk clothing for doll	F. Ukiah, Sacramento	Diploma.
Best display of Battenburg and point lace collars	Mrs. T. H. Wood, Suisun City	Diploma.
MISCELLANEOUS—AMATEURS.		
Best Battenburg bureau set	Mrs. Ross Guill, Chico	$1 00
Best dress and handiwork by child	Miss Anita Barrett, Sacramento	1 00
Best Battenburg sideboard scarf	Mrs. B. Muddox, Sacramento	1 00
Best hand-made clock frame of cones, shells, etc.	Miss V. H. Blacklock, Denverton	Sil. Med.
Best Battenburg bolero jacket	Miss Margaret A. Erhart, Sac'to	$1 00
CLASS III—PRINTING, LITHOGRAPHY, ETC.		
Best display of stationery	The A. S. Hopkins Co., Sac'to	2 00

Total amount of cash awards in Third Department $330 75

FOURTH DEPARTMENT.

MECHANICAL PRODUCTS.

Exhibit.	Exhibitor.	Award.
CLASS I—MANUFACTURES OF LEATHER, PAPER, AND RUBBER.		
Best set of double harness	A. Meister & Sons Co., Sac'to	$5 00
Best set of single harness	A. Meister & Sons Co., Sac'to	5 00
Best display of paper manufactured in California	The A. S. Hopkins Co., Sac'to	2 00
Best display of cordage	The A. S. Hopkins Co., Sac'to	2 00
Best display of shoe lasts	A. Casselli, Sacramento	1 00
Best pair dress boots, California manufacture	A. Casselli, Sacramento	5 00
Best pair heavy boots, California manufacture	A. Casselli, Sacramento	5 00
Best pair gentleman's shoes, California manufacture	A. Casselli, Sacramento	5 00

Fourth Department—Mechanical Products—Continued.

Exhibit.	Exhibitor.	Award.
CLASS I—MANUFACTURES OF LEATHER, PAPER, AND RUBBER—*Continued.*		
Best pair ladies' shoes, California manufacture	A. Casselli, Sacramento	$5 00
Best display of men's and boys' boots, shoes, gaiters, etc.	A. Casselli, Sacramento	2 00
Best display of ladies' and girls' boots, and shoes, and gaiters	A. Casselli, Sacramento	2 00
CLASS II—WORKED METALS.		
Best display of wire rope	American Steel and Wire Co., San Francisco	Sil. Med.
Best display of wire goods	American Steel and Wire Co., San Francisco	Sil. Med.
Best display of clocks	The A. S. Hopkins Co., Sac'to	$1 00
Best display of ornaments for outside work on buildings	Holbrook, Merrill & Stetson, Sac.	5 00
Best display of brass or copper cooking utensils	Holbrook, Merrill & Stetson, Sac.	5 00
Best display of brass goods, other than cooking utensils	Holbrook, Merrill & Stetson, Sac.	5 00
Best display of plumber's goods and wares	Holbrook, Merrill & Stetson, Sac.	2 00
Best display of electric lamps used in decorating	Holbrook, Merrill & Stetson, Sac.	5 00
Best display of table cutlery	Holbrook, Merrill & Stetson, Sac.	2 00
Best display of kitchen utensils, tin and tinware	Holbrook, Merrill & Stetson, Sac.	5 00
Best display of milk cans	Holbrook, Merrill & Stetson, Sac.	1 00
Best sample block-tin pipe	Holbrook, Merrill & Stetson, Sac.	1 00
Best exhibit of lead pipe	Holbrook, Merrill & Stetson, Sac.	1 00
Best display of wire supplies	Holbrook, Merrill & Stetson, Sac.	1 00
Best display of general hardware	Holbrook, Merrill & Stetson, Sac.	10 00
CLASS III—STOVES, CASTINGS, ETC.		
Best portable range for wood	Holbrook, Merrill & Stetson, Sac.	5 00
Best parlor stove for coal	Holbrook, Merrill & Stetson, Sac.	5 00
Best wickless oil cook stove	Holbrook, Merrill & Stetson, Sac.	5 00
Best laundry stove	Holbrook, Merrill & Stetson, Sac.	5 00
Best warming furnace or other apparatus	Holbrook, Merrill & Stetson, Sac.	5 00
Best pair ornamental iron vases	Holbrook, Merrill & Stetson, Sac.	3 00
Best display of hollowware	Holbrook, Merrill & Stetson, Sac.	5 00
Best farmer's caldrons or steamers	Holbrook, Merrill & Stetson, Sac.	5 00
Best assortment japanned ware	Holbrook, Merrill & Stetson, Sac.	5 00
Best display of cast-iron, enameled bath and wash tubs	Holbrook, Merrill & Stetson, Sac.	5 00
Best gas and water pipes	Holbrook, Merrill & Stetson, Sac.	1 00
Best water and steam gates	Holbrook, Merrill & Stetson, Sac.	1 00
Best cooking stove for coal	M. Hirsch, Sacramento	5 00
Best cooking stove for wood	M. Hirsch, Sacramento	5 00
Best parlor stove for wood	M. Hirsch, Sacramento	5 00
CLASS V—FURNITURE.		
Best set library furniture	Weinstock, Lubin & Co., Sac'to	10 00
Best set bedroom furniture	Capital Manufacturing Co., Sac.	10 00
Best set of school furniture	Capital Manufacturing Co., Sac.	10 00
Best davenport	Capital Manufacturing Co., Sac.	5 00
Best set of parlor chairs	Capital Manufacturing Co., Sac.	10 00
Best dressing bureau	Capital Manufacturing Co., Sac.	10 00
Best center-table	Capital Manufacturing Co., Sac.	5 00
Best display of willow furniture	Capital Manufacturing Co., Sac.	10 00
Best display of furniture	C. M. Campbell, Sacramento	2 00
Best display of drawing-room chairs	C. M. Campbell, Sacramento	10 00
Best set of dining-room furniture	C. M. Campbell, Sacramento	10 00
Best set of office furniture	C. M. Campbell, Sacramento	10 00
Best sofa	C. M. Campbell, Sacramento	5 00
Best lounge	C. M. Campbell, Sacramento	5 00
Best extension table	C. M. Campbell, Sacramento	5 00
Best serving table or buffet	C. M. Campbell, Sacramento	5 00
Best display of upholstery	C. M. Campbell, Sacramento	5 00

Fourth Department—Mechanical Products—Continued.

Exhibit.	Exhibitor.	Award.
CLASS V—FURNITURE—*Continued.*		
Best spring mattress	C. M. Campbell, Sacramento	$5 00
Best hair mattress	C. M. Campbell, Sacramento	5 00
Best wool mattress	C. M. Campbell, Sacramento	3 00
Best invalid's chair	C. M. Campbell, Sacramento	5 00
Best display of California woods	Richard Brown, Placerville	Sil. Med.
CLASS VI—WOODENWARE.		
Best display of pineware	The A. S. Hopkins Co., Sac'to	$5 00
Best display of cedarware	The A. S. Hopkins Co., Sac'to	5 00
Best display of oakware	The A. S. Hopkins Co., Sac'to	5 00
Best display of willowware	The A. S. Hopkins Co., Sac'to	5 00
Best display of splitwood baskets	The A. S. Hopkins Co., Sac'to	3 00
Best display of turning lathe work	The A. S. Hopkins Co., Sac'to	5 00
Best display of osier	The A. S. Hopkins Co., Sac'to	5 00
Best display of woodenware other than willow	The A. S. Hopkins Co., Sac'to	5 00
Best display of broomcorn, brooms, and brushes	The A. S. Hopkins Co., Sac'to	5 00
Best assortment of cooper's wares	The A. S. Hopkins Co., Sac'to	5 00
Best display of matches, in quality and variety	The A. S. Hopkins Co., Sac'to	1 00
CLASS VII—ELECTRICAL APPLIANCES, ETC.		
Best assortment of spectacles and eyeglasses, showing different styles and shapes of frames and nosepieces	F. C. Chinn, Sacramento	Sil. Med.
Best assortment of all kinds of unfinished convex, concave, cylindrical, and plano lenses	F. C. Chinn, Sacramento	Diploma.
Best assortment of all kinds of finished convex, concave, cylindrical, and plano lenses	F. C. Chinn, Sacramento	Diploma.
Best surveyor's compass	F. C. Chinn, Sacramento	Diploma.
Best achromatic telescope	F. C. Chinn, Sacramento	Diploma.
Best optical apparatus	F. C. Chinn, Sacramento	Diploma.
Best thermometer	F. C. Chinn, Sacramento	Diploma.
Best barometer	The A. S. Hopkins Co., Sac'to	$1 00
Best electric cooking apparatus	Holbrook, Merrill & Stetson, Sac.	5 00
CLASS VIII—CHEMICALS.		
Best display of soap	James Fox, San Francisco	S.M.&$10
Best castile soap	The A. S. Hopkins Co., Sac'to	1 00
Best axle grease	The A. S. Hopkins Co., Sac'to	1 00
Best stove polish, to be tested	M. Hirsch, Sacramento	Sil. Med.
CLASS IX—STONEWARE, BRICK, TILES, CROCKERY, GLASS, ETC.		
Best sample of drain tile	Cowell & Co., Sacramento	$5 00
Best display of terra cotta	Cowell & Co., Sacramento	10 00
Best display of firebrick	Cowell & Co., Sacramento	3 00
Best pressed brick	Cowell & Co., Sacramento	1 00
Best barrel of lime	Cowell & Co., Sacramento	1 00
Best hydraulic cement	Cowell & Co., Sacramento	1 00
Best plaster	Cowell & Co., Sacramento	1 00
Best demijohns	The A. S. Hopkins Co., Sac'to	1 00
Best exhibit of slate	Holbrook, Merrill & Stetson, Sac.	5 00
Best water pipe	H. Muddox, Sacramento	1 00
Best sewer pipe	H. Muddox, Sacramento	5 00
CLASS X—MINERALS, FOSSILS, BIRDS, FISHES, ETC.		
Best cabinet of agates, crystallized fossils and crystallized quartz	Bath Bros., Sacramento	25 00
CLASS XI—MARBLE AND GRANITE WORK.		
Best display of marble lavatories	Holbrook, Merrill & Stetson, Sac.	2 00

Fourth Department—Mechanical Products—Continued.

Exhibit.	Exhibitor.	Award.
CLASS XII—INCUBATORS.		
Best display of incubators in operation	Pacific Seed Co., Sacramento	$12 50
For incubator hatching greatest number of chicks	Pacific Seed Co., Sacramento	5 00
Best display of brooders	Pacific Seed Co., Sacramento	5 00
Best display of poultry houses	Pacific Seed Co., Sacramento	5 00
Best display of poultry fixtures	Pacific Seed Co., Sacramento	5 00
CLASS XIII—MISCELLANEOUS.		
Best display of hydraulic sandstone	W. H. Fisher, San Francisco	Sil. Med.
Best crude-oil burner for household purposes	Economy C. Oil B. Co., Oak Park	Diploma.
For magical lamp chimney	The A. S. Hopkins Co., Sac'to	Diploma.
For perfection curtain pole support and shade bracket	Ward & Moseley, San Francisco	Diploma.
For California oil gas burner	E. W. McDonald, Sacramento	Diploma.
For display of pine needle products	Pacific Pine Needle Co., San Fran.	Diploma.
Best gasoline launch	Baker & Hamilton, Sacramento	Sil. Med.
For perfection oil heater	M. Hirsch, Sacramento	Diploma.
For combination coal and wood range	M. Hirsch, Sacramento	Diploma.
For instantaneous water heater	Tom Scott, Sacramento	Diploma.
For oil gas burner	Geo. C. Morgan, San Francisco	Diploma.
For sunlight water heater in operation	M. M. Baker, Oakland	Diploma.
Best display of coal, coke, copper, etc.	Montezuma Mining Co., Sac'to	Diploma.

Total amount of cash awards in Fourth Department $453 50

FIFTH DEPARTMENT.

DAIRY PRODUCTS AND DAIRY UTENSILS.

Exhibit.	Exhibitor.	Award.
CLASS I—FRESH BUTTER.		
First premium	C. F. Andrews, Port Arena	$50 00
Second premium	Peter Phillipsen, Loleta	45 00
Third premium	Nels Eriksen, Miller	40 00
Fourth premium	C. A. Starkweather, San Fran.	35 00
Fifth premium	H. F. Lyon, Alameda	30 00
Sixth premium	George E. Newman, Lompoc	25 00
Seventh premium	Glanndale Dairy, Franklin	20 00
Eighth premium	J. H. Severin, Modesto	15 00
Ninth premium	C. A. Grossman, Greenview	10 00
Tenth premium	J. E. Thorp, Lockeford	5 00
STORAGE BUTTER.		
First premium	G. G. Knox, Grafton	30 00
Second premium	V. S. Howard, Half Moon Bay	25 00
Third premium	J. N. Kiser, Hollister	20 00
Fourth premium	Allan Quain, Stockton	15 00
Fifth premium	W. M. Turner, Sierraville	10 00
Sixth premium	George E. Newman, Lompoc	5 00
EXPORT BUTTER.		
First premium	Hills Bros., San Francisco	Sil. Med.
Second premium	Dairymen's Union of San Fran.	Bronze M.
Third premium	Hilmer & Bredhoff, San Fran.	Diploma.
CHEESE.		
First premium	James A. Howie, Compton	$10 00
Second premium	G. Muscio, Los Alamos	5 00

Fifth Department—Dairy Products and Utensils—Continued.

Exhibit.	Exhibitor.	Award.
CLASS II—DAIRY MACHINERY.		
Best hand cream separator	Joshua Hendy Mach. Wks., S. F.	$5 00
Best pasteurizing apparatus	Joshua Hendy Mach. Wks., S. F.	5 00
Best milk tester	Joshua Hendy Mach. Wks., S. F.	10 00
Best churn	Joshua Hendy Mach. Wks., S. F.	2 00
Best complete creamery outfit ready for operation	G. G. Wickson & Co., San Fran.	20 00
Best butter cutter and moulder	G. G. Wickson & Co., San Fran.	5 00
Best cream cooler	G. G. Wickson & Co., San Fran.	5 00
Best milk aërator and cooler	G. G. Wickson & Co., San Fran.	5 00
Best cream ripening vat	G. G. Wickson & Co., San Fran.	5 00
Best butter worker	G. G. Wickson & Co., San Fran.	2 00
Best power cream separator	DeLaval Separator Co., San Fran.	10 00
Best combined churn and worker	Baker & Hamilton, Sacramento	10 00
Best milk delivery can	Baker & Hamilton, Sacramento	2 00

Total amount of cash awards in Fifth Department $481 00

SIXTH DEPARTMENT.

HORTICULTURAL PRODUCTS.

Exhibit.	Exhibitor.	Award.
CLASS I—DECIDUOUS FRUITS.		
Apples.		
Best display, embracing quality and variety	R. A. Day, Placerville	$25 00
Second best	R. C. Williamson, Sacramento	15 00
Best arranged exhibit	R. A. Day, Placerville	10 00
Best twelve varieties	R. A. Day, Placerville	5 00
Best five varieties	R. C. Williamson, Sacramento	3 00
Best packed box for shipment	Mrs. A. Barrett, Sacramento	3 00
Pears.		
Best display, embracing quality and variety	R. C. Williamson, Sacramento	25 00
Second best	Mrs. E. Shields, Mills Station	15 00
Best arranged exhibit	R. A. Day, Placerville	10 00
Best twelve varieties	Mrs. E. Shields, Mills Station	5 00
Best five varieties	R. A. Day, Placerville	3 00
Best packed box for shipment	Mrs. A. Barrett, Sacramento	3 00
Peaches.		
Best display, embracing quality and variety	R. C. Williamson, Sacramento	25 00
Second best	R. A. Day, Placerville	15 00
Best arranged exhibit	R. C. Williamson, Sacramento	10 00
Second best	R. A. Day, Placerville	5 00
Best twelve varieties	R. C. Williamson, Sacramento	10 00
Second best	R. A. Day, Placerville	5 00
Best five varieties	R. A. Day, Placerville	7 50
Best packed box for shipment	Mrs. A. Barrett, Sacramento	5 00
Nectarines.		
Best display, embracing quality and variety	R. C. Williamson, Sacramento	25 00
Best arranged exhibit	R. C. Williamson, Sacramento	10 00
Best five varieties	R. C. Williamson, Sacramento	3 00

SIXTH DEPARTMENT—HORTICULTURAL PRODUCTS—Continued.

Exhibit.	Exhibitor.	Award.
Plums and Prunes.		
Best display, embracing quality and variety	R. C. Williamson, Sacramento	$25 00
Second best	R. A. Day, Placerville	15 00
Best arranged exhibit	R. C. Williamson, Sacramento	10 00
Second best	R. A. Day, Placerville	5 00
Best twelve varieties	R. C. Williamson, Sacramento	10 00
Second best	R. A. Day, Placerville	5 00
Best five varieties	R. A. Day, Placerville	7 50
Second best	Mrs. E. Shields, Mills Station	5 00
Figs.		
Best display, embracing quality and variety	R. C. Williamson, Sacramento	10 00
Best five varieties of figs	R. C. Williamson, Sacramento	5 00
CLASS II—OLIVES.		
For most meritorious exhibit	J. P. Odbert, Sacramento	25 00
Second best	R. C. Williamson, Sacramento	15 00
Best exhibit of cured or pickled olives (ripe)	J. P. Odbert, Sacramento	10 00
Second best	R. C. Williamson, Sacramento	5 00
Best exhibit of pickled olives (green)	J. P. Odbert, Sacramento	10 00
Best exhibit of dried olives	R. C. Williamson, Sacramento	10 00
Second best	J. P. Odbert, Sacramento	5 00
CLASS IV—CULTIVATED NUTS.		
Best exhibit of walnuts, embracing quality and variety	Mrs. B. Muddox, Sacramento	15 00
Second best	J. P. Odbert, Sacramento	10 00
Best ten varieties of walnuts	Mrs. B. Muddox, Sacramento	15 00
Second best	J. P. Odbert, Sacramento	7 50
Best and largest exhibit of almonds, embracing quality and variety	J. P. Odbert, Sacramento	15 00
Second best	Mrs. E. Shields, Mills Station	10 00
Best ten varieties of almonds	J. P. Odbert, Sacramento	15 00
Second best	Mrs. B. Muddox, Sacramento	7 50
Best exhibit of filberts	Mrs. B. Muddox, Sacramento	5 00
Best exhibit of chestnuts	J. P. Odbert, Sacramento	5 00
Best exhibit of peanuts	Mrs. B. Muddox, Sacramento	5 00
Second best	J. P. Odbert, Sacramento	3 00
CLASS V—TABLE GRAPES.		
Best display, embracing quality and variety	Mrs. E. Shields, Mills Station	25 00
Second best	R. C. Williamson, Sacramento	15 00
Best twelve varieties	Mrs. E. Shields, Mills Station	10 00
Best five varieties	R. C. Williamson, Sacramento	5 00
Second best	Mrs. E. Shields, Mills Station	3 00
Best three varieties	P. Roemer, Sacramento	5 00
Second best	R. C. Williamson, Sacramento	3 00
CLASS VI—DRIED AND PRESERVED FRUITS.		
Largest and best exhibit of dried fruit, embracing quality and variety, by producer	Mrs. E. Shields, Mills Station	50 00
Second largest and best	R. A. Day, Placerville	25 00
Best 25-lb. box dried apples, by producer	R. C. Williamson, Sacramento	5 00
Second best	Mrs. E. Shields, Mills Station	3 00
Best 25-lb. box dried pears, by producer	Mrs. E. Shields, Mills Station	5 00
Second best	R. C. Williamson, Sacramento	3 00
Best 25-lb. box dried peaches, by producer	Mrs. E. Shields, Mills Station	5 00
Second best	R. C. Williamson, Sacramento	3 00
Best 25-lb. box dried plums, by producer	Mrs. E. Shields, Mills Station	5 00
Best 25-lb. box dried prunes, by producer	Mrs. E. Shields, Mills Station	5 00
Second best	R. C. Williamson, Sacramento	3 00
Best 25-lb. box dried apricots, by producer	R. C. Williamson, Sacramento	5 00
Second best	Mrs. E. Shields, Mills Station	3 00
Best 25-lb. box dried nectarines, by producer	R. C. Williamson, Sacramento	5 00
Second best	Mrs. E. Shields, Mills Station	3 00
Best packed commercial box dried apples	Mrs. E. Shields, Mills Station	5 00
Best packed commercial box dried peaches	Mrs. E. Shields, Mills Station	5 00
Best packed commercial box dried pears	Mrs. E. Shields, Mills Station	5 00

SIXTH DEPARTMENT—HORTICULTURAL PRODUCTS—Continued.

Exhibit.	Exhibitor.	Award.
CLASS VI—DRIED FRUITS—*Continued.*		
Best packed commercial box dried prunes	Mrs. E. Shields, Mills Station	$5 00
Best packed commercial box dried apricots	Mrs. E. Shields, Mills Station	5 00
Best packed commercial box dried plums	R. A. Day, Placerville	5 00
Best packed com'rc'l box dried nectarines	R. A. Day, Placerville	5 00
Best variety of dried prunes	Mrs. E. Shields, Mills Station	5 00
CLASS VII—DRIED FRUIT COOKING FORMULAS.		
Best exhibit of cooked dried fruits (with formulas), to be cooked daily during the Fair	Mrs. E. Shields, Mills Station	50 00
CLASS IX—HONEY, PRESERVES, PICKLES, ETC.		
Best display of jams and jellies, in glass	Mrs. A. Barrett, Sacramento	25 00
Second best	Mrs. B. Muddox, Sacramento	15 00
Best display of honey	Mrs. B. Muddox, Sacramento	20 00
Second best	A. C. Eastman, Walnut Grove	10 00
Best display of preserved fruits, in glass	Mrs. B. Muddox, Sacramento	10 00
Second best	Mrs. E. Shields, Mills Station	5 00
Best six jars raspberry jelly	Mrs. A. Barrett, Sacramento	3 00
Second best	Mrs. B. Muddox, Sacramento	2 00
Best six jars currant jelly	Mrs. E. Shields, Mills Station	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best six jars blackberry jelly	Mrs. B. Muddox, Sacramento	3 00
Second best	Mrs. E. Shields, Mills Station	2 00
Best six jars strawberry jelly	Mrs. E. Shields, Mills Station	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best six jars quince jelly	Mrs. B. Muddox, Sacramento	3 00
Second best	Mrs. E. Shields, Mills Station	2 00
Best six jars guava jelly	Mrs. B. Muddox, Sacramento	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best six jars loquat jelly	Mrs. A. Barrett, Sacramento	3 00
Second best	Mrs. B. Muddox, Sacramento	2 00
Best six jars orange jelly	Mrs. E. Shields, Mills Station	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best six jars lemon jelly	Mrs. B. Muddox, Sacramento	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best six jars blackberry jam	Mrs. E. Shields, Mills Station	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best six jars plum jelly	Mrs. A. Barrett, Sacramento	3 00
Second best	Mrs. E. Shields, Mills Station	2 00
Best six jars apple jelly	Mrs. E. Shields, Mills Station	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best six jars grape jelly	Mrs. A. Barrett, Sacramento	3 00
Second best	Mrs. E. Shields, Mills Station	2 00
Best cucumber pickles	Mrs. B. Muddox, Sacramento	3 00
Second best	R. C. Williamson, Sacramento	2 00
Best pickled onions	Mrs. B. Muddox, Sacramento	3 00
Second best	R. C. Williamson, Sacramento	2 00
Best six jars chowchow	Mrs. E. Shields, Mills Station	3 00
Second best	Mrs. B. Muddox, Sacramento	2 00
Best sweet pickled peaches	Mrs. A. Barrett, Sacramento	3 00
Second best	Mrs. E. Shields, Mills Station	2 00
Best sweet pickled grapes	Mrs. E. Shields, Mills Station	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best sweet pickled plums	Mrs. B. Muddox, Sacramento	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best sweet pickled cucumbers	Mrs. B. Muddox, Sacramento	3 00
Second best	R. C. Williamson, Sacramento	2 00
Best six jars raspberry jam	Mrs. B. Muddox, Sacramento	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best display orange marmalade	Mrs. E. Shields, Mills Station	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best display of pickles	Mrs. B. Muddox, Sacramento	3 00
Second best	R. C. Williamson, Sacramento	2 00
Best display of brandied peaches	Mrs. E. Shields, Mills Station	3 00
Second best	Mrs. A. Barrett, Sacramento	2 00
Best fig marmalade	Mrs. B. Muddox, Sacramento	3 00

Sixth Department—Horticultural Products—Continued.

Exhibit.	Exhibitor.	Award.
CLASS XI—MISCELLANEOUS.		
Best display of quinces, embracing quality and variety	Mrs. A. Barrett, Sacramento	$10 00
Second best	R. C. Williamson, Sacramento	5 00
Best display of pomegranates of more than three varieties	J. P. Odbert, Sacramento	10 00
Second best	Mrs. E. Shields, Mills Station	5 00
SPECIAL PREMIUMS IN THIS DEPARTMENT.		
For the best arranged and most extensive, perfect, and varied exhibit of orchard products	Mrs. E. Shields, Mills Station	100 00
For second best arranged and most extensive, perfect, and varied exhibit of orchard products	R. C. Williamson, Sacramento	50 00
For third best arranged and most extensive, perfect, and varied exhibit of orchard products	R. A. Day, Placerville	25 00

Total amount of cash awards in Sixth Department $1,232 00

SEVENTH DEPARTMENT.

VITICULTURAL PRODUCTS, ETC.

Exhibit.	Exhibitor.	Award.
CLASS VI—WINE GRAPES.		
Best display of wine grapes, not less than eight varieties	Mrs. E. Shields, Mills Station	$12 50
Best display of wine grapes, not less than three varieties	Mrs. E. Shields, Mills Station	10 00
Second best	P. Roemer, Sacramento	5 00
CLASS VII—CIDER.		
Best apple cider, with formula	R. C. Williamson, Sacramento	5 00
CLASS VIII—VINEGAR.		
Best barrel of pure wine vinegar, exhibited by manufacturer	F. C. De Long, San Francisco	10 00
Best barrel of pure cider vinegar, exhibited by manufacturer	Western Yeast & Vinegar Co., S. F.	10 00
CLASS IX—BEER.		
Best display of lager beer	Buffalo Brewing Co., Sacramento	Dip.&$10
Best display of export beer	Buffalo Brewing Co., Sacramento	Dip.&$10
Best display of keg beer	Buffalo Brewing Co., Sacramento	Dip.& $5
CLASS X—MISCELLANEOUS.		
For display of Clo-Tho, made from California fruits and lemon juice	F. Henry Hecker, Los Angeles	Sil. Med.

Total amount of cash awards in Seventh Department $77 50

EIGHTH DEPARTMENT.

AGRICULTURAL PRODUCTS.

Exhibit.	Exhibitor.	Award.
CLASS I—FARM PRODUCTS.		
For the most extensive, perfect, and varied exhibit of farm products grown by one person or farm	Mrs. A. Barrett, Sacramento	$100 00
Second premium	Mrs. E. Shields, Mills Station	50 00
Third premium	R. C. Williamson, Sacramento	25 00
CLASS II—COTTON AND TOBACCO.		
Best display of California leaf tobacco	Seb. Hemberger, Sacramento	15 00
Second best	Mrs. E. Shields, Mills Station	10 00
Best display of California manufactured tobacco	Moll Bros., Sacramento	S.M. & $5
CLASS III—FLOUR AND GRAIN.		
Best sample of Australian wheat	Mrs. E. Shields, Mills Station	$3 00
Best sample of White Chile wheat	Phœnix Milling Co., Sacramento	3 00
Best sample of White Club wheat	Phœnix Milling Co., Sacramento	3 00
Best sample of Proper wheat	Phœnix Milling Co., Sacramento	3 00
Best sample of Sonora wheat	Phœnix Milling Co., Sacramento	3 00
Best sample of Odessa wheat	Phœnix Milling Co., Sacramento	3 00
Best sample of Chevalier barley	Mrs. A. Barrett, Sacramento	3 00
Best sample of rye	Pacific Seed Co., Sacramento	3 00
Best sample of barley	A. C. Eastman, Walnut Grove	3 00
Best sample of oats	Mrs. A. Barrett, Sacramento	3 00
Best sample of buckwheat	Pacific Seed Co., Sacramento	3 00
Best sample of baker's flour	Phœnix Milling Co., Sacramento	Diploma.
Best sample of family flour	Brighton Milling Co., Sacramento	Diploma.
Best display of hops, quality and variety considered	Horst Bros., San Francisco	$5 00
Best sample of timothy seed	Pacific Seed Co., Sacramento	3 00
Best sample of clover seed	Pacific Seed Co., Sacramento	3 00
Best sample of mesquit grass seed	Pacific Seed Co., Sacramento	3 00
Best sample of blue grass seed	Pacific Seed Co., Sacramento	3 00
Best sample of red-top clover seed	Pacific Seed Co., Sacramento	3 00
Best sample of orchard grass seed	Pacific Seed Co., Sacramento	3 00
Best and greatest variety of wheat in ear or head	Mrs. A. Barrett, Sacramento	5 00
Best exhibit of alfalfa seed	Mrs. A. Barrett, Sacramento	5 00
Best exhibit of yellow corn	Mrs. E. Shields, Mills Station	5 00
Best exhibit of white corn	Pacific Seed Co., Sacramento	5 00
Best exhibit of sweet corn	Pacific Seed Co., Sacramento	5 00
Best exhibit of garden seeds of California production, not less than twenty-five varieties	Pacific Seed Co., Sacramento	25 00
Second best	Mrs. A. Barrett, Sacramento	15 00
Best and largest display of grain in the sheaf	Mrs. E. Shields, Mills Station	40 00
Second best	Mrs. A. Barrett, Sacramento	20 00
CLASS IV—VEGETABLES, ROOTS, ETC.		
Best display of canning and shipping tomatoes, embracing quality and variety	Mrs. A. Barrett, Sacramento	15 00
Second best	P. Sani & Co., Sacramento	10 00
Best and greatest variety of Irish potatoes	Mrs. A. Barrett, Sacramento	7 50
Best and greatest variety of sweet potatoes	Mrs. A. Barrett, Sacramento	5 00
Best sack of sweet potatoes	Mrs. A. Barrett, Sacramento	3 00
Best display of parsnips	Mrs. A. Barrett, Sacramento	3 00
Best display of carrots	Mrs. A. Barrett, Sacramento	3 00
Best display of blood beets	Mrs. A. Barrett, Sacramento	3 00
Best display of sugar beets	Mrs. A. Barrett, Sacramento	5 00
Best box of tomatoes	Mrs. A. Barrett, Sacramento	2 00
Best display of drum-head cabbage	Mrs. A. Barrett, Sacramento	2 00
Best display of Dutch cabbage	Mrs. A. Barrett, Sacramento	2 00
Best display of any other variety	Mrs. A. Barrett, Sacramento	2 00
Best display of cauliflower	Mrs. A. Barrett, Sacramento	2 00

EIGHTH DEPARTMENT—AGRICULTURAL PRODUCTS—Continued.

Exhibit.	Exhibitor.	Award.
CLASS IV—VEGETABLES, ETC.—*Continued.*		
Best display of broccoli	Mrs. A. Barrett, Sacramento	$2 00
Best display of lettuce	Mrs. A. Barrett, Sacramento	2 00
Best display of red onions	Mrs. A. Barrett, Sacramento	2 00
Best display of squashes	Mrs. E. Shields, Mills Station	5 00
Best display of yellow onions	Mrs. A. Barrett, Sacramento	2 00
Best display of white onions	Mrs. A. Barrett, Sacramento	2 00
Best display of peppers for pickling	Mrs. A. Barrett, Sacramento	2 00
Best display of salsify	Mrs. A. Barrett, Sacramento	2 00
Best display of celery	Mrs. A. Barrett, Sacramento	2 00
Best and largest pumpkin	Mrs. A. Barrett, Sacramento	5 00
Beet display of sweet corn, green	Mrs. A. Barrett, Sacramento	2 00
Best display of watermelons	Mrs. A. Barrett, Sacramento	3 00
Best display of cantaloupes	Mrs. A. Barrett, Sacramento	3 00
Best display of cucumbers	Mrs. A. Barrett, Sacramento	2 00
Best display of lima beans, in pod	Mrs. A. Barrett, Sacramento	2 00
Best display of white beans, dried	Mrs. A. Barrett, Sacramento	2 00
Best display of kidney bush beans, in pod	Mrs. A. Barrett, Sacramento	2 00
Best display of pole beans, other than lima, in pod	Mrs. A. Barrett, Sacramento	2 00
Best display of field beans, dried	Mrs. A. Barrett, Sacramento	2 00
Best display of gherkin cucumbers	Mrs. A. Barrett, Sacramento	2 00
Best display of purple egg plants	Mrs. A. Barrett, Sacramento	2 00
Best display of cañaigre roots	Mrs. A. Barrett, Sacramento	5 00
Best display of mangel-wurzels	Mrs. A. Barrett, Sacramento	5 00
Best display of garden peas, dried	Pacific Seed Co., Sacramento	2 00
Best and greatest variety of peas, dried	Pacific Seed Co., Sacramento	2 00
CLASS V—FLOWERS.		
For most attractive general exhibit of ornamental nursery stock	H. McWilliams, Sacramento	50 00
Second best	F. A. Ebel, Sacramento	25 00
Best and largest collection of flowering plants in bloom	H. McWilliams, Sacramento	25 00
Second best	F. A. Ebel, Sacramento	15 00
Best collection of ornamental foliage plants	F. A. Ebel, Sacramento	10 00
Best collection of cut flowers	F. A. Ebel, Sacramento	25 00
Second best	H. McWilliams, Sacramento	15 00
Best collection of new and rare plants	F. A. Ebel, Sacramento	15 00
Best display of coleus, distinct varieties	H. McWilliams, Sacramento	10 00
Best collection of roses in bloom	H. McWilliams, Sacramento	5 00
Best collection of fuchsias in bloom	F. A. Ebel, Sacramento	5 00
Best collection of tuberoses in bloom	H. McWilliams, Sacramento	10 00
Second best	F. A. Ebel, Sacramento	5 00
Best collection of pinks	H. McWilliams, Sacramento	10 00
Second best	F. A. Ebel, Sacramento	5 00
Best collection of ferns	H. McWilliams, Sacramento	10 00
Second best	F. A. Ebel, Sacramento	5 00
Best collection of plants suitable for greenhouse, conservatory, and window culture	H. McWilliams, Sacramento	10 00
Second best	F. A. Ebel, Sacramento	5 00
Best display of hanging baskets containing plants	H. McWilliams, Sacramento	10 00
Second best	F. A. Ebel, Sacramento	5 00
CLASS VI—CURED MEATS, BREAD, ETC.		
Best display of packing-house meats	Cudahy Packing Co., San Fran.	Spec.G.M.
Best display of home-cured hams, bacon and lard, with formula	Mrs. E. Shields, Mills Station	$20 00
Second best	Mrs. A. Barrett, Sacramento	10 00
Best display and best soda biscuit	Mrs. B. Muddox, Sacramento	5 00
Best display and best biscuit	Mrs. W. F. Smith, Sacramento	2 00
Best display and best domestic brown bread	Mrs. W. F. Smith, Sacramento	2 00
Best display and best domestic rye bread	Mrs. W. F. Smith, Sacramento	2 00
Best display and best graham bread	Mrs. B. Muddox, Sacramento	2 00
Best display and best domestic wheat bread	Mrs. B. Muddox, Sacramento	2 00
Best display and best domestic bread	Mrs. W. F. Smith, Sacramento	5 00
Second best display and best domestic bread	Mrs. W. F. Smith, Sacramento	2 00

EIGHTH DEPARTMENT—AGRICULTURAL PRODUCTS—Continued.

Exhibit.	Exhibitor.	Award.
CLASS VII—SUGAR, SYRUP, EXTRACTS, CONFECTIONS, AND CANDY.		
Best display of syrup made from either sugar beets or cane, not less than five gallons	H. Fisher, Sacramento	$5 00
Best general display of confectionery	H. Fisher, Sacramento	5 00
Best general varieties of candies made in the hall during the exhibition	H. Fisher, Sacramento	5 00
CLASS VIII—MISCELLANEOUS.		
Best display of vegetable plants in bearing	Mrs. A. Barrett, Sacramento	2 00
Best display of rhubarb roots	Mrs. A. Barrett, Sacramento	1 00
For Sweetheart chewing gum	H. Fisher, Sacramento	Sil. Med.

Total amount of cash awards in Eighth Department $859 50

NINTH DEPARTMENT.

FINE ARTS.

Exhibit.	Exhibitor.	Award.
CLASS I—OIL PAINTINGS, WATER COLORS, CRAYONS, CHARCOAL, AND PASTELS.		
Twelve oil paintings	H. R. Bloomer, San Francisco	$25 00
Fourteen oil paintings	C. Jonnevold, San Francisco	25 00
Seventeen oil paintings	J. A. Stanton, San Francisco	45 00
Six oil paintings	C. E. Rixford, San Francisco	10 00
Fourteen oil paintings	H. S. Fonda, San Francisco	20 00
Four oil paintings	Mary E. Bruenn, Oakland	5 00
Four oil paintings	S. M. Farnam, San Francisco	10 00
Twelve oil paintings	Annie Harmon, San Francisco	10 00
Nine oil paintings	Jos. M. Cleary, San Francisco	15 00
Five oil paintings	A. M. Best, San Francisco	10 00
Two oil paintings	R. D. Yelland, San Francisco	15 00
Nine oil paintings	Marion Drewe, San Francisco	20 00
Ten oil paintings	Mary T. Menton, San Francisco	20 00
Three oil paintings	Nellie E. B. Scott, San Francisco	5 00
Four oil paintings	H. Gremke, San Francisco	10 00
Three oil paintings	Alice M. Best, San Francisco	10 00
Nine oil paintings	C. T. Piazzoni, San Francisco	15 00
Nine oil paintings	Alice M. Bremer, San Francisco	10 00
Four oil paintings	Nellie L. Treat, San Francisco	10 00
One oil painting	Evelyn McCormick, San Fran.	15 00
Six oil paintings	B. S. Lee, San Francisco	20 00
Eight oil paintings	Josephine Eckler, San Francisco	10 00
Four oil paintings	C. A. Rogers, San Francisco	10 00
Four oil paintings	Kate M. Maher, San Francisco	10 00
Five oil paintings	H. MacCartney, San Francisco	15 00
Six oil paintings	L. P. Latimer, San Francisco	15 00
Four oil paintings	J. N. Jackson, San Francisco	15 00
Two oil paintings	H. M. Sherwood, Oakland	5 00
Two oil paintings	Mrs. Rose Campbell, Oakland	5 00
Three oil paintings	Amanda Austin, Sacramento	10 00
Eight oil paintings	F. H. Thompson, Oakland	5 00
One oil painting	N. L. DeNubila, Sacramento	5 00
Two oil paintings	M. Kleinsorge, Sacramento	5 00
One oil painting	Alice Chittenden, San Francisco	10 00
Two oil paintings	Leola Hall, San Francisco	5 00
Twelve oil paintings	Miss De Neale Morgan, Oakland	15 00
Four oil paintings	Mazie D. Nichols, Oakland	10 00
Three oil paintings	Andrew P. Hill, San José	15 00
Four oil paintings	Mrs. John Dolan, Sacramento	5 00
Five oil paintings	Martha Patterson, San Francisco	10 00
Eight oil paintings	Annie F. Briggs, San Francisco	15 00

NINTH DEPARTMENT—FINE ARTS—Continued.

Exhibit.	Exhibitor.	Award.
CLASS I—OIL PAINTINGS—*Continued.*		
Twelve oil paintings	L. Vesario, San Francisco	$10 00
Three oil paintings	K. C. Thompson, San Francisco	5 00
One oil painting	Miss B. Delmus, San Francisco	5 00
Two oil paintings	Edith Whitfield, San Francisco	5 00
Three oil paintings	Gertrude Zinders, San Francisco	5 00
One oil painting	H. Schmidt, San Francisco	5 00
Seven oil paintings	Mrs. Herrick, Sacramento	10 00
Seven oil paintings	C. P. Neilson, San Francisco	10 00
Two oil paintings	W. H. Leffler, San Francisco	5 00
Two oil paintings	Ruth McCarthy, San Francisco	5 00
One oil painting	H. Sayle, San Francisco	5 00
Two oil paintings	Miss E. C. Stone, San Francisco	5 00
Six oil paintings	W. F. Jackson, Sacramento	75 00
Ten oil paintings	J. M. Gamble, San Francisco	S.M.&$30
Two charcoal studies	A. M. Bremer, San Francisco	$3 00
CLASS II—PHOTOGRAPHS.		
Display of photographs	Andrew P. Hill, San José	S.M.&$20
Display of photographs	H. L. Allen, Sacramento	$10 00
Display of photographs	Laura Adams, San Francisco	10 00
Display of photographs	N. E. White, Sacramento	10 00
CLASS III—ETCHINGS, INDIA INK, PEN AND PENCIL DRAWINGS.		
Pen and ink exhibit	Examiner Artists, San Francisco	8 00
Twelve pen and ink sketches	Amanda P. Austin, Sacramento	S.M.&$20
Seven pen and ink sketches	Josephine Eckler, San Francisco	$8 00
Three pen and ink sketches	Alice M. Best, San Francisco	5 00
Two pen and ink sketches	Frank Kleinsorge, Sacramento	3 00
Decorative designs	P. Lemos, San Francisco	3 00
CLASS IV—STATUARY, FRESCO, MOSAIC, AND CARVED WORK.		
Three pieces of sculpture	F. Peano, Oakland	S.M.&$25
Two bas-relief pieces	Gertrude Boyle, San Francisco	$10 00
CLASS V—PENMANSHIP.		
Best single sample of penmanship, the individual work of exhibitor	C. N. Faulk, Sacramento	5 00
For the most meritorious display of penmanship, the work of exhibitor, by a resident of California	C. N. Faulk, Sacramento	Sil. Med.
CLASS VII—CALIFORNIA DRAWINGS AND DESIGNS.		
Best display of mechanical or geometrical free-hand penmanship or drawing, of any kind or character, by any class in the public schools	Sacramento City Public Schools	$20 00
Best mechanical free-hand drawing	C. Luhrs, Sacramento	Sil. Med.
Best original mechanical drawing of any kind	R. B. Giffen, Sacramento	Sil. Med.
Best plan or design of city residence	A. Freedlund, Sacramento	Sil. Med.
Best drawing or example of applied ornament in classic architecture	G. E. Hook, Sacramento	Sil. Med.
Best display of mechanical or geometrical free-hand penmanship or drawing, of any kind or character, by any class in a commercial or business college	Howe's Academy, Sacramento	Sil. Med.

Total amount of cash awards in Ninth Department $870 00

GOLD MEDALS AWARDED.

To J. H. Glide, for meritorious exhibit of Ramboulette sheep.

To Cudahy Packing Company, for Rex brand of bacon and lard.

CREAMERY SCORES.

The fresh and storage butter in the State Fair exhibit ranged as follows in the average of the scores. The names of creamery and buttermaker are given, so far as the latter is known:

FRESH BUTTER.

Point Arena Creamery, C. F. Andrews	97.50
Sunset Creamery, Peter Phillipsen	97.16
Bridgeport Creamery, Nels Eriksen	97.00
Hygeia Creamery, C. A. Starkweather	96.91
Jersey Creamery, H. F. Lyon	96.41
Lompoc Creamery, George E. Newman	96.25
Glanndale Creamery, Clyde McClaran	95.91
Modesto Creamery, J. H. Severin	95.83
Siskiyou Creamery, C. A. Grossman, Greenview	95.75
Lockeford Creamery, J. E. Thorp	95.58
Hygeia Creamery (pasteurized, complimentary)	95.16
Danish Creamery, Eric Larsen	95.00
Diamond Mountain Creamery, Fred Leiser	94.91
Hollister Creamery, Joseph N. Kiser	94.75
Sheppard Creamery	94.66
Castroville Creamery, Charles Fisher	94.58
Springbrook Creamery, W. M. Turner	93.41
Minnewawa Creamery, S. Koppes	92.16
New Era Creamery, D. Brough	90.75
Los Baños Creamery	79.33

COLD STORAGE BUTTER.

Knights Landing Creamery, G. G. Knox	96.50
Pillarcitos Sunset Creamery, V. S. Howard	94.58
Hollister Creamery, Joseph N. Kiser	94.50
Stockton Creamery, Allan Quain	92.58
Springbrook Creamery, W. M. Turner	89.08
Lompoc Creamery, George E. Neuman	88.00

EXPORT BUTTER.

Basis for scoring—Flavor, 30; Grain, 30; Color, 10; Salt, 10; Package, 20.

Hill Bros. Flavor, 29; grain, 29; color, 10; salt, 10; package, 18; total, 96

"Eagle" brand, Dairymen's Union Flavor, 27$\frac{1}{12}$; grain, 29½; color, 9½; salt, 10; package, 5; total, 81½

"Golden Poppy," Hilmer & Bredhoff Flavor, 27; grain, 29; color, 9; salt, 10; package, 5; total, 80

CHEESE.

Factory No. 338, G. Muscio, Los Alamos	96
Factory No. 44, J. A. Howie, Compton	94

SCORES ON BUTTER AT CALIFORNIA STATE FAIR, 1901.

Scored September 10th.

Judges—Leroy Anderson, W. H. Roussel, and W. D. McArthur.

FRESH BUTTER.

Basis for scoring—Flavor, 50; Grain, 25; Color, 10; Salt, 10; Package, 5.

EXHIBITOR.	ANDERSON.					ROUSSEL.					M'ARTHUR.				
	Fl.	Gr.	C.	S.	P.	Fl.	Gr.	C.	S.	P.	Fl.	Gr.	C.	S.	P.
Point Arena Creamery, Point Arena.	48	24½	10	10	5	48½	24	10	10	5	48½	24	10	10	5
Sunset Creamery, Loleta.	48½	23¾	10	10	5	48	24¾	10	10	4½	48	24	10	10	5
Bridgeport Creamery, Miller.	48¼	24¾	10	10	5	46½	25	10	10	5	48	24	10	10	5
Hygeia Creamery, San Francisco.	48	24¼	10	10	5	46¾	24¾	10	10	5	48	24	10	10	5
Jersey Creamery, Alameda.	47¾	23½	9¾	10	5	48	24¼	9¾	10	5	48	23½	9¾	10	5
Lompoc Creamery, Lompoc.	47½	24	9¾	10	5	48	24½	9½	9¾	5	47½	23½	9¾	10	5
Glanndale Creamery, Franklin.	48½	22½	10	10	4¾	48½	23¼	10	10	4¾	48	22½	10	10	5
Modesto Creamery, Modesto.	46½	24	9¾	10	5	46¾	24½	10	10	5	47	24	10	10	5
Siskiyou Creamery, Greenview.	47	23½	9½	10	4¾	47	24½	10	9¾	4¾	47½	24	10	10	5
Lockeford Creamery, Lockeford.	47	23¾	9¾	10	5	46½	24	10	9¾	5	47½	23¾	9¾	10	5
Hygeia Creamery (Pasteurized, complimentary.)	46¾	23½	9¾	10	5	47	24	9¾	10	5	46½	23¼	10	10	5
Danish Creamery, Fresno.	46	23¾	10	10	4¾	46	24¼	10	10	4¾	46¾	24	10	10	4¾
Diamond Mt. Creamery, Susanville.	46	24	10	10	4¾	46	24½	10	9¾	4¾	46	24¼	10	10	4¾
Hollister Creamery, Hollister.	45½	24	10	10	5	46	24¼	10	10	5	45½	24	10	10	5
Sheppard Creamery, Point Arena.	46	24½	9¾	10	4¾	46	24	10	10	4¾	45½	24½	9½	10	4¾
Castroville Creamery, Castroville.	46¼	23½	9¾	10	5	46	24¼	9½	9½	5	46½	24	9½	10	5
Springbrook Creamery, Sierraville.	44¾	24¼	9¾	9½	4½	45	24¾	10	9¼	4½	45½	24½	10	9	5
Minnewawa Creamery, Fresno.	45	23	9½	10	5	44½	22½	9¼	10	4¾	46	22½	9½	10	5
New Era Creamery, Newman.	45¼	21	9½	10	4¾	45	22	9½	9¾	4¾	45	22	9	10	4¾
Los Baños Creamery, Los Baños.	42	21	8½	10	0	40	21	8	9	0	39	22	8	0	½

COLD STORAGE BUTTER.

EXHIBITOR.	ANDERSON.					ROUSSEL.					M'ARTHUR.				
	Fl.	Gr.	C.	S.	P.	Fl.	Gr.	C.	S.	P.	Fl.	Gr.	C.	S.	P.
Knights Landing C'ry, Grafton.	47	24	10	10	4¾	47	25	10	10	4¾	48	24	10	10	5
Pillarcitos Sunset C'ry, Half Moon Bay.	46½	23¼	10	10	5	46	23½	10	10	4¾	46¼	23½	10	10	5
Hollister Creamery, Hollister.	45	24¾	9¾	10	5	44½	25	10	10	5	45	24½	10	10	5
Stockton Creamery, Stockton.	44	24	10	10	4	44	24½	10	10	4¼	45	23¾	10	10	4¼
Springbrook Creamery, Sierraville.	41	24¼	9¼	10	5	41	24½	9	10	4¾	41	24¼	8¾	10	5
Lompoc Creamery, Lompoc.	40	24	9½	10	4¾	40	24¾	9¼	10	4¾	40	23	9	10	5

SPEED PROGRAMME.

MONDAY, SEPTEMBER 2, 1901.

Race No. 1—Trotting.

Occident Stake for 1901; for foals of 1898. Mile heats, three in five. Entries closed January 2, 1899. $100 entrance, of which $10 accompanied nomination; $15 paid January 1, 1900; $25 paid January 1, 1901; and $50 thirty days before the race. The Occident Cup, of the value of $400, added by the Society. First colt to receive cup and six tenths; second colt, three tenths; and third colt, one tenth of the stakes. Value, $2,595.

1. W. Hogoboom's (Marysville) b. c. Charles H, by Lynmont—Elmorene.
2. Thomas S. Manning's (Avalon) b. c. Commander Muckle, by McKinney—Cheerful.
3. C. A. Owen's (Clovis) ch. c. Lee Roy, by Waldstein—Zadie McGregor.
4. Santa Rosa Stock Farm's (Santa Rosa) ch. f. Lou Dillon, by Sidney Dillon—Lou Milton.
5. D. J. Desmond's (Riverside) b. f. Italia, by Zombro—Concha.
6. J. Doran's (Oakland) b. f. Della McCarty, by McKinney—Lady C.

SUMMARY.

Italia (W. Maben)	1	1	1
Commander Muckle (F. Ward)	3	2	2
Charles H (W. Hogoboom)	2	dis.	
Della McCarty (G. Boyd)	dis.		

Time—2:25, 2:23½, 2:27¼.

Race No. 2—Pacing.

2:12 class. Purse, $500. Mile heats, three in five.

1. S. C. Tryon & Co.'s (Sacramento) blk. m. Margaretta, by Direct—Rosita A.
2. J. H. Thompson's (Riverside) ch. g. El Diablo, by Diablo—Elwood.
3. A. L. Conkling's (Bakersfield) b. m. Edna R, by Sidney—by Director.
4. J. F. Snover's (Newport) b. m. Floracita, by Red Cloak—Maggie H.
5. C. W. Main's (Corona) b. m. Queen R, by Redondo—by Adrian Wilkes.
6. Mrs. Vioget's (Lawrence) b. h. Wildnutling, by Wildnut—Helena.
7. J. D. Heines's (San Francisco) br. h. John A, by Wayland W—Lady Moor.
8. J. B. Iverson's (Salinas) ch. m. Dictatress, by Dictatus—Salinas Belle.

SUMMARY.

El Diablo (C. Farrar)	4	1	1	1
John A (W. Masten)	5	2	2	r. o.
Edna R (I. Mulholland)	3	4	3	r. o.
Dictatress (J. H. Vance)	6	5	4	r. o.
Margaretta (J. Lafferty)	1	7	dis.	
Wildnutling (J. W. Donathan)	2	3	dis.	
Floracita (G. H. Judd)	7	6	dis.	
Queen R (F. Ward)	dis.			

Time—2:13, 2:14, 2:13¼, 2:20¾.

Race No. 3—Running.

For three-year-olds and over that have not won three races in 1901. Seven and one half furlongs. Selling. Purse, $225; of which $40 to second and $15 to third. Winner to be sold for $200. Beaten non-winners and beaten maidens in 1901 allowed 5 lbs. additional

1. R. J. Gardner's ch. g. Mefford (4), by Shannon—Miss Mitford; 107 lbs.
2. J. Coffey's ch. g. Galanthus (3), by July—Snowdrop; 106 lbs.
3. Owen Bros.' ch. f. Conejo (4), by Royal Flush—Lady Emma; 109 lbs

4. Wm. Cahill's b. g. Rinaldo (6), by Leonatus—Dahlia; 112 lbs.
5. Thomas Latta's b. g. Pongo (6), by El Rio Rey—Ogalena; 107 lbs.
6. George Miller's b. g. Decoy (4), by Imp. Deceiver—Nantucket; 112 lbs.
7. O. Appleby's ch. g. Ringmaster (a), by Buckmaster—Grisette; 112 lbs.
8. D. Morgan's b. g. McFarlane (6), by Imp. Mariner—Moonlight; 107 lbs.

SUMMARY.

Decoy (Foucon)	1
Rinaldo (Hoar)	2
Conejo (Russell)	3

Time—1:35¼.

Race No. 4—Running.

For all ages. Five and one half furlongs. Selling. Purse, $250; of which $40 to second and $20 to third. Winner to be sold for $600. 5 lbs. below scale. Non-winners of five races of any value in 1901 allowed 5 lbs.; of three races in 1901, 7 lbs.; beaten non-winners of a race in 1901, 12 lbs.

1. Lone Stable's b. g. Cavanaugh (3), by Imp. Idalium—Lady Cleveland; 99 lbs.
2. Martin Duffy's b. m. Phlegon (4), by Imp. Piccolo—Little Rose; 105 lbs.
3. W. L. Stanfield's br. m. Kitty Kelly, (4), by Apache—Playtoy; 114 lbs.
4. C. Young's ch. m. Good Hope (4), by Col. Clark—Gratitude; 114 lbs.
5. E. Kaufman's ch. m. Katie Walcott (4), by Prince Royal—Penelope; 102 lbs.
6. J. S. Gibson's b. f. Narra G (3), by Bloomsbury—Czarina; 101 lbs.
7. J. P. Atkins's br. c. Achilles (2), by St. Carlo—Moonlight; 86 lbs.
8. G. W. Snider & Co.'s ch. m. Vantine (4), by Imp. Anchorite—Vestina; 109 lbs.
9. J. Coffey's ch. f. Evea G (2), by Imp. Juvenal—Sister Geneva; 81 lbs.

SUMMARY.

Narra G (Howson)	1
Good Hope (J. McCarty)	2
Kitty Kelly (Foucon)	3

Time—1:07.

Race No. 5—Running.

For two-year olds that have not won two races in 1901. Five furlongs. Purse, $225; of which $40 to second and $15 to third. 5 lbs. below scale. Non-winners of a race allowed 5 lbs.

1. Stanfield & Ellis's br. f. Flo Culver (2), by Lew Weir—Juanita; 110 lbs.
2. L. A. Blasingame's b. c. Porous (2), by Wernberg—Chevy Chase; 113 lbs.
3. G. W. Snider & Co. ch. f. Quadra (2), by Imp. Prestonpans—Miss Belinda; 105 lbs.
4. S. F. Capps's b. c. Gypsy Boy (2), by Imp. True Briton—Gypsy Girl; 113 lbs.
5. Lone Stable's ch. g. Col. Smith (2), by Thornhill—Tillie S; 108 lbs.
6. F. D. Weir's br. f. Flattered (2), by Emperor—Flattery; 105 lbs.
7. P. Donalache's b. g. Sol (2), by Imp. Trentolo—Ursula; 113 lbs.
8. E. Lanigan's br. g. Hainault (2), by St. Carlo—Libbertiflibbet; 113 lbs.
9. P. Guilfoyle's b. g. Redan (2), by Imp. Artillery—Princess Noretta; 108 lbs.
10. A. J. Stemler's ch. c. Quiet (2), by Imp. Gold Finch—Silence; 113 lbs.
11. Gil Summers & Co.'s ch. g. Rubina (2), by Imp. Star Ruby—Torsina; 113 lbs.

SUMMARY.

Hainault (J. McCarty)	1
Rubina (Foucon)	2
Quadra (Russell)	3

Time—1:01.

Race No. 6—Running.

For three-year-olds and upward, non-winners of more than one race this year. Six furlongs. Selling. 10 lbs. below scale. Non-winners allowed 5 lbs. All to be sold for $200.

1. Wm. Cahill's b. c. Lief Prince (3), by Prince Lief or Bermuda—Natalie; 106 lbs.
2. H. Whitman's br. g. Whaleback (5), by Imp. Duncombe—Orange Leaf; 112 lbs.
3. G. Burger's b. f. Mamie Hildreth (3), by Thornhill—Mamie H; 98 lbs.
4. C. W. Carroll's b. f. Artilla (4), by Artillery—Duchess of Towers; 109 lbs.

5. P. Holly's br. g. Bob Palmer (3), by King Regent—Crescendo; 101 lbs.
6. M. Kane's br. g. Herald (4), by Herald—Acquito; 112 lbs.
7. C. T. Rector's ch. m. Mountain Dew (5), by Blazes—Alice B; 109 lbs.
8. E. G. McConnell's ch. m. Lost Girl (5), by Sobrante—Nellie K; 109 lbs.
9. G. Secrest & Co.'s b. f. Roundhead (3), by Puryear D—Miss Cromwell; 98 lbs.

SUMMARY.

Whaleback (Burlingame)	1
Lost Girl (J. McCarty)	2
Mamie Hildreth (J. Tullett)	3

Time—1:16.

TUESDAY, SEPTEMBER 3, 1901.

RACE NO. 7—PACING.

2:20 class. Purse, $500. Mile heats, three in five.

1. Santa Rosa Stock Farm's (Santa Rosa) ch. g. B. S. Dillon, by Sidney Dillon.
2. W. M. Bartee's (Riverside) blk. g. Midnight, by Nutford—by Grandee.
3. J. A. Lafferty's (Oakland) br. h. Advertisor, by Advertiser—by Steinway.
4. Ed Graser's (Riverside) ch. m. Nellie I, by Gossiper.
5. Vendome Stock Farm's (San José) ch. m. Our Boy's Sister, by Baywood—Wapsie.
6. W. Vanderhurst's (Salinas) b. m. Diablita, by Diablo—by Carr's Mambrino.
7. R. R. Brown's (Oakland) b. m. Miramonte, by Diablo—Cresco.
8. R. Freeman's (Red Bluff) b. m. Banker's Daughter, by Arthur Wilkes—Sunflower.

SUMMARY.

Midnight (D. Donahue)	1	1	2	1
Banker's Daughter (Wm. Brown)	5	3	1	2
Our Boy's Sister (C. F. Bunch)	3	2	3	r. o.
Advertisor (J. A. Lafferty)	4	4	4	r. o.
B. S. Dillon (Geo. Ramage)	2	5	dis.	
Miramonte (H. D. Brown)	dis.			
Diablita (J. Dwain)	dis.			

Time—2:14½, 2:14¾, 2:14¾, 2:17.

RACE NO. 8—TROTTING.

2:40 class. Purse, $800. Mile heats, three in five.

1. Vendome Stock Farm's (San José) b. m. Nora McKinney, by McKinney—by Dexter Prince.
2. A. Joseph's (San Francisco) ch. m. Floradora, by Sable Steinway—Pearl.
3. W. S. Maben's (Los Angeles) b. g. Cornelius D, by McKinney—by Bob Mason.
4. P. Foley's (Oakland) br. m. Lady Granard, by McKinney—Igo Antevolo.
5. Thomas Morton's (Sacramento) b. g. Albert X, by Albert W—by Echo.
6. D. F. Oglesby's (Carpenteria) b. h. Almonada, by Eros—Maggie E.
7. Grace Bros.' (Santa Rosa) br. h. Ole, by Silas Skinner—Eleaven.
8. John Quinn's (Santa Rosa) blk. h. Black Bart, by Robin—by Williamson's Belmont.
9. A. G. Gurnett's (San Francisco) gr. g. What Is It, by Direct—Lassie Jean.
10. I. Mulholland's (Independence) br. g. Peter Jackson, by Designer—by Abbotsford.
11. R. Freeman's (Red Bluff) b. g. Prince L, by Escort—Queen L.
12. T. C. Cabney's (Eureka) br. m. Pearl K, by Wayland W—by The Grand Moor.
13. S. J. Dunlop's (Los Angeles) b. m. Lucy G, by Junio—Lofty.
14. George F. Jacobs's (Nevada City) br. g. Walling, by Waldstein—by Pasha.
15. C. Dennison's (Los Angeles) b. h. McKenna, by McKinney—Etta Wilkes.
16. Tuttle Bros.' (Rocklin) b. m. Rosalind, by Stam B—Klickitat Maid.

SUMMARY.

Black Bart (J. Quinn)	7	2	1	1	1
Nora McKinney (C. F. Bunch)	1	1	3	2	2
Cornelius D (W. S. Maben)	3	4	2	r. o.	
Almonada (H. Delaney)	2	5	6	r. o	
Lucy G (J. R. Albertson)	4	6	4	r. o.	
McKenna (F. E. Ward)	5	3	5	r. o.	
Peter Jackson (J. Depoister)	6	7	7	r. o.	
Walling (J. Dwain)	dis.				
Albert X (Thomas Norton)	dis.				

Time—2:19¼, 2:16¼, 2:17¼, 2:21, 2:25.

RACE NO. 9—RUNNING.

For two-year-olds. Five and one half furlongs. Purse, $225; of which $40 to second and $15 to third. 5 lbs. below the scale. A non-winner of a stake race, if a non-winner of three races, allowed 5 lbs.; of two races and maidens, 7 lbs; beaten maidens, 12 lbs.

1. E. B. Smith's ch. g. Resin (2), by Ransom—Atlantus; 101 lbs.
2. J. S. Campbell's ch. f. Innocencia (2), by Emp. Norfolk—Espiritu Santa; 110 lbs.
3. Neil & Mackey's ch. c. Charette (2), by Imp. Crighton or Eolo—Fatina; 101 lbs.
4. C. W. Carroll's br. f. Roselaw (2), by Bassetlaw—Rosalind; 105 lbs.
5. Stanfield & Ellis's br. f. Flo Culver (2), by Lew Weir—Juanita; 103 lbs.
6. P. E. Smith's ch. g. Fred Atterbury (2), by Bowling Green—Kitty Waddle; 101 lbs.
7. J. P. Atkins's ch. g. Glendenning (2), by St. Carlo—Glenlevit; 113 lbs.

SUMMARY.

Glendenning (Logue)	1
Innocencia (J. McCarty)	2
Flo Culver (J. Dugan)	3

Time—1:07.

RACE NO. 10—RUNNING.

Flash Stake; for all ages. Six furlongs. Entrance $10, to accompany nomination; $20 additional for horses not declared by 4 p. m. the day preceding the race; $400 added by the Society, of which $70 to second and $30 to third. Non-winners of three races this year, if three years old and over, allowed 5 lbs.; non-winners of two races, 7 lbs.; and non-winners of one race, 10 lbs. Maidens, three years old, allowed 5 lbs.; four years old and over, 7 lbs. additional. Closed with 17 entries. Total value, $670.

1. Owen Bros.' b. f. Flush of Gold (3), by Royal Flush—Gold Cup; 112 lbs.
2. J. S. Gibson's b. f. Narra G (3), by Bloomsbury—Czarina; 106 lbs.
3 C. Young's ch. g. Meehanus (5), by Imp. Golden Garter—Fidalma; 122 lbs.
4. R. Wilson's ch. g. Byron Rose (3), by Ducat—Rose Magenta; 106 lbs.
5. Gil Summers & Co.'s ch. g. True Blue (a), by Duke of Norfolk—Carmen; 115 lbs.

SUMMARY.

Flush of Gold (Hoar)	1
Meehanus (J. McCarty)	2
Byron Rose (J. McDermit)	3

Time—1:13.

RACE NO. 11—RUNNING.

For-three-year-olds. Six furlongs. Selling. Purse, $250; of which $40 to second and $20 to third. Winner to be sold for $800; if for less, 2 lbs. allowed for each $100 down to $200. Non-winners of three races in 1901 allowed 5 lbs.

1. F. D. Weir's br. c. Flatterer (3), by Emperor—Flattery; 110 lbs.
2. J. D. Dunn's br. g. Pegalong (3), by Imp. Crighton—Sweet Peggy; 105 lbs.
3. L. A. Blasingame's b. g. Grafter (3), by Cicero—Leapyear; 114 lbs.
4. C. Young's ch. f. Eonic (3), by Eon—Mermaid; 109 lbs.
5. E. Carey's b. g. David S (3), by Midlothian—Taluda; 110 lbs.

SUMMARY.

David S (Logue)	1
Eonic (J. McCarty)	2
Flatterer (Hoar)	3

Time—1:13¾.

RACE NO. 12—RUNNING.

For four-year-olds and over. One mile. Selling. Purse, $225; of which $40 to second and $15 to third. 7 lbs. below scale. Non-winners of three races in 1901 allowed 5 lbs.; of two races, 8 lbs.; of a race. 12 lbs. Winner to be sold for $250.

1. George Miller's br. h. Sir Hampton (4), by Water Cress—Imp. Lizzie Hampton; 115 lbs.
2. E. B. Smith's b. g. Sea Spray (a), by Imp. Mariner—Marinet; 103 lbs.
3. J. McGovern's ch. m. Torsida (6), by Torso—Judith; 104 lbs.
4. D. F. Cox's ch. m. Castaine (5), by Eotheon—Pearlfinder; 100 lbs.
5. C. Earl's b. m. Coming Event (4), by Imp. Calvados—Katrinka; 104 lbs.
6. Lone Stable's br. g. Casdale (5), by Favordale—Castalia; 103 lbs.

7 F. D. Weir's ch. g. Merops (5), by Brutus—Merope; 115 lbs.
8. J. S. Campbell's b. g. Burdock (4), by Imp. Matt Byrnes—Alva Daly; 115 lbs.
9. T. E. McLaughlin's b. g. Mike Rice (a), by J. H. Fenton—Mrs. McAllister—115 lbs.

SUMMARY.

Sir Hampton (Foucon)	1
Coming Event (Ross)	2
Merops (Hoar)	3

Time—1:41½.

WEDNESDAY, SEPTEMBER 4, 1901.

Race No. 13—Pacing.

Stake for three-year-old pacers. Mile heats, three in five. $10 entrance; $20 additional from starters; $250 added. All moneys to be divided 60, 30, and 10 per cent.

1. James A. Daly's (Napa) b. c. Osmont, by Altamont—Saturn.
2. T. W. Barstow's (San José) b. f. Alone, by Wilkes Direct—Grenelt.
3. J. Eviston's (San Francisco) b. g. Joe Eviston, by Seymour Wilkes—by Nephew.
4. R. H. Nason's (Dixon) b. f. Fidelity, by Falrose—Mischief.
5. F. E. Wright's (Sacramento) b. m. Pearl Sinclair, by Hanford Medium—Algaveta.

SUMMARY.

Osmont (Ward)	2	3	1	1	1
Pearl Sinclair (W. Tryon)	3	2	2	r. o.	
Joe Eviston (J. Cincello)	1	1	dis.		

Time—2:22, 2:25, 2:29½, 2:30, 4:20.

Race No. 14—Pacing.

For all horses eligible to the 2:18 class. Purse, $400. Mile heats, three in five.

1. Wm. Vanderhurst's (Salinas) b. m. Diablita, by Diablo—Salinas Maid.
2. R. R. Brown's (Oakland) b. m. Miramonte, by Diablo—Cresco.
3. A. M. Leeper's (Reno) br. g. Wilfred L, by Bozer—Lady H.
4. Ed. Kavanaugh's (Vallejo) ch. s. Gaff Topsail, by Diablo—Belle.
5. John Donohue's (San Bernardino) b. c. Richard B, by Woolsey—by Ten Broeck.
6. W. Maston's (San Francisco) b. g. Penrose, by Falrose—by Brigadier.

SUMMARY.

Gaff Topsail (J. Smith)	1	1	1
Richard B (D. Donahue)	2	3	2
Diablita (J. Dwain)	3	2	5
Wilfred L (R. C. Leeper)	5	4	3
Penrose (W. Maston)	4	5	4
Miramonte (H. D. Brown)	dis.		

Time—2:19½, 2:16, 2:18¼.

Race No. 15—Running.

For three-year-olds and over, maidens and non-winners of a race of 1901. Six furlongs. Selling. Purse, $225; of which $40 to second and $15 to third. Three-year-olds to carry 107 lbs.; four and over, 110 lbs.; those beaten three or more times in 1901, allowed 5 lbs. Winner to be sold for $200.

1. C. W. Carroll's b. f. Chaste (3), by Jim Gore—Imp. British Blue Blood; 99 lbs.
2. D. Morgan's b. g. McFarlane (6), by Imp. Mariner—Moonlight; 105 lbs.
3. P. Holly's br. g. Bob Palmer (3), by King Regent—Crescendo; 102 lbs.
4. Secrest & Co.'s b. f. Roundhead (3), by Puryear D—Miss Cromwell; 99 lbs.
5. J. Webb's br. g. San Augustine (5), by Emperor of Norfolk—The Hook Blind; 105 lbs.
6. Owen Bros.' b. h. Grady (a), by Three Cheers—Gold Cup; 110 lbs.
7. Thomas Latta's b. g. Pongo (6), by El Rio Rey—Ogalena; 105 lbs.
8. P. L. Rector's b. g. Pent Etre (3), by General Miles—Vellicht; 102 lbs.
9. John Lodge's br. f. Little Gun (3), by Imp. Artillery—Queen Kapiolana; 107 lbs.

SUMMARY.

McFarlane (Burlingame)	1
San Augustine (Ashley)	2
Grady (Russell)	3

Time—1:15½.

RACE NO. 16—RUNNING.

The Shafter Stake; for two-year-olds. Six furlongs. Entrance $10, to accompany nomination; $15 additional for colts not declared by 4 P. M. the day preceding the race; with $300 added by the Society, of which $50 to second and $25 to third. Horses may be entered not to be sold, and carry rule weight. If entered to be sold for $1,000, allowed 3 lbs.; $700, 6 lbs.; $400, 10 lbs. Winners of one race after closing of stake to carry 3 lbs. extra; of two or more, 7 lbs. extra. Maidens beaten three times allowed 5 lbs.; four or more times, 7 lbs. Closed with 20 entries. Total value, $590.

1. J. Coffey's ch. f. Evea G (2), by Imp. Juvenal—Sister Geneva; 105 lbs.
2. A. J. Stemler's br. f. Divina (2), by Bassetlaw—Angelete; 105 lbs.
3. J. P. Atkins's br. c. Achilles (2), by St. Carlo—Moonlight; 108 lbs.
4. W. B. Sink, Jr.'s b. g. Royalty (2), by Imp. Cavalier—Empress of Norfolk; 105 lbs.
5. G. Summers & Co.'s br. g. Water Scratch (2), by Imp. Water Cress—Helen Scratch; 108 lbs.
6. G. Summers & Co.'s ch. g. Rubina (2), by Imp. Star Ruby—Torsina; 105 lbs.

SUMMARY.

Achilles (Hoar)	1
Divina (Russell)	2
Royalty (J. McCarty)	3

Time—1:14½.

RACE NO. 17—RUNNING.

For three-year-olds and over. Six furlongs. Selling. Purse, $250; of which $40 to second and $20 to third. Winner to be sold for $700; 2 lbs. allowed on each $100 down to $200. Non-winners of two races in 1901 allowed 5 lbs.

1. E. Carey's b. f. Catherine Bravo (3), by Rio Bravo—Catherine B; 103 lbs.
2. E. Kaufman's b. m. Katie Walcott (4), by Prince Royal—Penelope; 104 lbs.
3. Wm. Cahill's b. g. Prestidigitator (4), by Russell—Active; 114 lbs.
4. L. Tryon's b. m. Galene (4), by Imp. Brutus—Picnic; 104 lbs.
5. J. Coffey's ch. g. Galanthus (3), by July—Snowdrop; 101 lbs.
6. G. Burger's b. f. Mamie Hildreth (3), by Thornhill—Mamie H; 104 lbs.
7. P. Crowley's br. h. Gusto (4), by Brutus—Irish Lass; 116 lbs.
8. H. Whitman's ch. g. Fine Shot (4), by Balgowan—Dignity; 107 lbs.
9. C. Young's ch. m. Good Hope (4), by Col. Clark—Gratitude; 111 lbs.
10. G. L. Richardson's blk. Pidalia (4), by Idalium—Piquante; 104 lbs.
11. J. L. Rector's ch. m. Lou Clievden (4), by Imp. Clievden—Miss Lou; 109 lbs.

SUMMARY.

Good Hope (J. McCarty)	1
Mamie Hildreth (Howson)	2
Catherine Bravo (Logue)	3

Time—1:14½.

RACE NO. 18—RUNNING.

For three-year-olds and over, maidens and non-winners of a race in 1901. Six furlongs. Selling. Purse, $225; of which $40 to second and $15 to third. Three-year-olds to carry 107 lbs.; four and over, 110 lbs.; those beaten three or more times in 1901 allowed 5 lbs. Winner to be sold for $200.

1. W. D. Hayes's b. g. Ravino (3), by Racine—Precious; 102 lbs.
2. P. E. Smith's b. m. Little Sister (a), by Imp. Friar Tuck—Lowland Lass; 107 lbs.
3. Walter Maben's b. m. Miss Vera (4), by Amigo S—Fame; 107 lbs.
4. W. B. Jennings's ch. g. Canderos (4), by Candlemas—Hinda Dwyer; 107 lbs.
5. Lone Stable's b. g. Cavanaugh (3), by Imp. Idalium—Lady Cleveland; 102 lbs.
6. M. Kane's b. g. Heraldo (4), by Herald—Acquito; 110 lbs.
7. Murray & Collins's ch. g. Toribio (a), by Apache—Marin; 105 lbs.
8. R. J. Gardner's ch. g. Mefford (4), by Shannon—Miss Mitford; 105 lbs.
9. James Martin, Jr.'s b.m. Phlegon (4), by Imp. Piccolo—Little Rose; 110 lbs.

SUMMARY.

Miss Vera (Howson)	1
Phlegon (Russell)	2
Ravino (Bozeman)	3

Time—1:14.

THURSDAY, SEPTEMBER 5, 1901.

RACE NO. 19—PACING AND TROTTING.

For members of Sacramento Driving Club.

1. F. E. Wright's (Sacramento) br. h. Baby Button, by Alexander Button—Algerine.
2. H. A. Bell's (Sacramento) ch. m. Pansy, by Prompter—by Black Hawk.
3. L. S. Upson's (Sacramento) b. m. Regina F, by Alto Rex—by Nephew.
4. F. J. Ruhstaller, Jr.'s (Sacramento) b. g. Monroe B, by Monroe.
5. Charles Paine's (Sacramento) br. g. Pio, by Fern—Sunflower.
6. William Trust's (Sacramento) br. g. Candy Joe, by Berlin.
7. F. M. Enos's (Sacramento) b. h. John the First, by Stanton Wilkes.

SUMMARY.

Monroe B (F. J. Ruhstaller, Jr.)	4	3	1	1	1
Baby Button (F. E. Wright)	1	2	2	2	2
Pio (C. W. Paine)	3	4	3	r. o.	
Regina F (L. S. Upson)	2	1	dis.		
Candy Joe (Wm. Trust)	5	dis.			
Pansy (H. A. Bell)	dis.				

Time—2:20, 2:22, 2:22, 2:28, 2:30.

RACE NO. 20—TROTTING.

2:14 class. Purse, $1,000. Mile heats, three in five.

1. Valencia Stock Farm's (Los Angeles) br. m. Bet Madison, by James Madison—Betsy Trotwood.
2. W. S. Maben's (Los Angeles) gr. h. Richmond Chief, by Monroe Chief—by A. W. Richmond.
3. T. J. Crowley's (San Francisco) br. h. Boydello, by Boydell—by Durango Chief.
4. George F. Anderson's (San José) b. g Claudius, by Nutwood Wilkes—Fannie Menlo.
5. George A. Kelly's (Pleasanton) b. m. Anzella, by Antrim—Hazel Kirke.
6. M. M. Hackett's (Alhambra) b. h. Geo. W. McKinney, by McKinney—Lady Washington.
7. I. Mulholland's (Independence) br. h. Osito, by McKinney—Twilight.
8. I. Zimmerman's (Portland, Or.) br. g. McBriar, by McKinney—Briar Bell.
9. S. H. Hoy's (Winters) br. g. McNally, by McKinney—by Alcazar.
10. G. P. McNeil's (Fresno) r. g. Dan W, by Hero—by Mambrino Prince.
11. E. J. Baldwin's (Los Angeles) blk. h. Santa Anita Star, by Guy Wilkes—Sulta B.

SUMMARY.

Anzella (Geo. A. Kelly)	1	1	1
Dan W (J. R. Albertson)	3	2	2
Claudius (T. W. Barstow)	2	3	3
Osito (I. Mulholland)	4	4	4
Boydello (E. Lafferty)	dis.		

Time—2:17, 2:16, 2:15½.

RACE NO. 21—RUNNING.

For two-year-olds. Five and one half furlongs. Selling. Purse, $250. Winner to be sold for $700; 3 lbs. off for each $100 to $200. Beaten non-winners at this meeting allowed 5 lbs. Maidens, 10 lbs.

1. J. P. Atkins's ch. g. Glendenning (2), by St. Carlo—Glenlevit; 109 lbs.
2. W. B. Jennings & Co.'s b. c. Lapidus (2), by Imp. Star Ruby—Pearl V; 103 lbs.
3. Lone Stable's ch. g. Col. Smith (2), by Thornhill—Tillie S; 93 lbs.
4. J. D Dunn's ch. c. Marelio (2), by Imp. Mariner—Fidelia; 103 lbs.
5. F. Lanigan's br. g. Hainault (2), by St. Carlos—Libbertiflibbet; 106 lbs.
6. R. Hughes's b. g. Ah (2), by Santiago—Alasco; 93 lbs.

SUMMARY.

Glendenning (Logue)	1
Lapidus (Ransch)	2
Marelio (Ross)	3

Time—1:08.

Race No. 22—Running.

Sacramento State Fair Selling Stake; for three-year-olds and upward. One mile. Entrance $10, to accompany nomination; $20 additional for horses not declared by 4 P. M. day preceding the race; $400 added by the Society, of which $70 to second and $30 to third. Winner to be sold at auction. If for $2,000, to carry rule weight; if for less, 1 lb. allowed on each $100 to $1,000; thence 2 lbs. for each $100 to $400. A winner of a stake race or three or more races of any value after closing of stake, to carry 5 lbs. extra. Maidens allowed 7 lbs. Closed with 17 entries. Total value, $670.

1. Burns & Waterhouse's b. g. Scotch Plaid (6), by Imp. Midlothian—Mottle; 106 lbs.
2. G. Summers & Co.'s ch. m. True Blue (5), by Duke of Norfolk—Carmen; 102 lbs.
3. Geo. Miller's br. c. Sir Hampton (4), by Water Cress—Imp. Lizzie Hampton; 100 lbs.

SUMMARY.

Sir Hampton (Logue)	1
Scotch Plaid (Ransch)	2
True Blue (Holmes)	3

Time—1:40.

Race No. 23—Running.

For three-year-olds and over that have not won two races this year. Seven and one half furlongs. All to be sold for $200. 10 lbs. below the scale. Horses beaten at this meeting allowed 5 lbs.; and if four years old and over, 7 lbs.

1. J. McGovern's ch. m. Torsida (6), by Torso—Judith; 102 lbs.
2. J. Weber's b. m. Lizzella (a), by Morello—Lizzie Dunbar; 112 lbs.
3. Lone Stable's b. g. Casdale (5), by Imp. Favordale—Castalia; 105 lbs.
4. C. W. Carroll's b. f. Artilla (4), by Artillery—Duchess of Towers; 102 lbs.
5. Charles Earl's b. m. Coming Event (4), by Imp. Calvados—Katrinka; 102 lbs.
6. D. F. Cox's ch. m. Castaine (5), by Eotheon—Pearlfinder; 112 lbs.
7. J. Coffey's ch. g. Galanthus (3), by Imp. July—Snowdrop; 97 lbs.
8. Owen Bros.' ch. f. Conejo (4), by Royal Flush—Lady Emma; 102 lbs.
9. P E. Smith's ch. m. Nettie Clark (4), by Rio Bravo—Apollinaris; 109 lbs.

SUMMARY.

Torsida (J. McCarty)	1
Artilla (Burlingame)	2
Coming Event (Ross)	3

Time—1:35.

Race No. 24—Running.

For all ages. Five eighths of a mile. Selling. Purse, $200; of which $30 to second and $15 to third. Winner of three races in 1901 to carry 7 lbs. extra. Winner to be sold for $200.

1. D. F. Cox's b. m. Clarando (5), by Clarandon—Voltando; 119 lbs.
2. E. Kaufman's ch. m. Katie Walcott (4), by Prince Royal—Penelope; 112 lbs.
3. J. L. Rector's ch. m. Lou Clievden (4), by Imp. Clievden—Miss Lou; 119 lbs.
4. H. L. Haskell's ch. g. Gold Baron (5), by Imp. Rayon d'Or—Ballerina; 122 lbs.
5. P. Sullivan's br. g. Almoner (5), by Midlothian—Charity; 122 lbs.
6. E. Carey's b. g. David S (3), by Midlothian—Taluda: 123 lbs.
7. S. F. Capp's b. c. Gypsy Boy (2), by Imp. True Briton—Gypsy Girl; 96 lbs.
8. F. D. Weir's br. g Mike Strauss (4), by Iroquois—Gipsy; 129 lbs.
9. P. Moore's b. g. First Shot (4), by Foul Shot—Gratitude; 122 lbs.
10. H. Whitman's ch. g. Fine Shot (4), by Balgowan—Dignity II; 122 lbs.
11. Frank Allen's b. m. Blue Bell (a), by Prince of Norfolk—Gem of the Mountains; 126 lbs.

SUMMARY.

Almoner (J. McCarty)	1
Katie Walcott (Bozeman)	2
Clarando (Russell)	3

Time—1:01¼.

FRIDAY, SEPTEMBER 6, 1901.

RACE NO. 25—TROTTING.

2:20 class. Purse, $800. Mile heats, three in five.

1. Vendome Stock Farm's (San José) ch. g. Thomas R, by Iran Alto—by Yadrel.
2. A. Joseph's (San Francisco) ch. m. Floradora, by Sable Steinway—Pearl.
3. L. M. Clark's (Sacramento) b. h. Ouiboul, by Stamboul—Ouida.
4. D. J. Oglesby's (Carpentera) b. h. Almonada, by Eros—Maggie E.
5. Grace Bros.' (Santa Rosa) br. h. Ole, by Silas Skinner—Eleaven.
6. R. Freeman's (Red Bluff) b. g. Prince L, by Escort—Queen L.
7. George F. Jacobs's (Nevada City) br. g. Walling, by Waldstein—by Pasha.
8. C. Denison's (University) b. h. McKenna, by McKinney—Etta Wilkes.
9. F. C. Ward's (University) b. g. The Tout, by Apollo—by Raymond.
10. A. G. Gurnett's (San Francisco) gr. g. What Is It, by Direct—Lassie Jean.
11. James Dwain's (Salinas) b. g. Shelby, by Wilkes Moor—Queen.

SUMMARY.

Almonada (H. Delaney)	1	4	1	1
Thomas R (C. F. Bunch)	2	1	7	2
The Tout (F. Ward)	3	2	2	r. o.
Floradora (E. Lafferty)	5	3	3	r. o.
Ouiboul (L. M. Clark)	4	5	5	r. o.
Prince L (Wm. Brown)	6	7	4	r. o.
Walling (J. Dwain)	7	8	6	r. o.
Ole (J. Quinn)	8	6	8	r o.

Time—2:18¾, 2:19¼, 2:21¼, 2:25.

RACE NO. 26—TROTTING AND PACING.

Drummer's race. Purse, $250. Mile heats, three in five.

1. H. A. Bell's (Sacramento) b. g. Abdine.
2. E. F. Peart's (Sacramento) b. g. Deacon
3. W. F. Peterson's (Sacramento) b. m. Little Maid.
4. Bert Wertheimer's (Sacramento) b. m. Pearl Sinclair.
5. L. S. Upson's (Sacramento) b. m. Polka Dot.

SUMMARY.

Abdine (H. A. Bell)	3	3	1	1	1
Little Maid (W. F. Peterson)	1	1	2	2	2
Polka Dot (L. S. Upson)	2	5	3	r. o.	
Pearl Sinclair (B. Wertheimer)	5	2	5	r. o.	
Deacon (E. F. Peart)	4	4	4	r. o.	

Time—2:27¼, 2:28½, 2:24, 2:30, 2:48.

RACE NO. 27—RUNNING.

For maiden two-year-olds. Five furlongs. Purse, $225; of which $40 to second and $15 to third. 5 lbs. below the scale. Horses beaten three or more times allowed 5 lbs.; and if they have not been placed second or third, 5 lbs. additional.

1. R. Hughes's b. f. Jennie Hughes (2), by Racine—Aurelia II; 110 lbs.
2. F. D. Weir's b. f. Flattered (2), by Emperor—Flattery; 105 lbs.
3. W. B. Jennings & Co.'s b. f. Lulette (2), by Bassetlaw—Lulu; 105 lbs.
4. Lone Stable's b. f. Yankee Dame (2), by Yankee Doodle—Dame Marjorie; 110 lbs.
5. P. Guilfoyle's b. g. Redan (2), by Imp. Artillery—Princess Noretta; 108 lbs.
6. G. W. Snider & Co.'s ch. f. Quadra (2), by Prestonpans—Miss Belinda; 105 lbs.

SUMMARY.

Quadra (Logue)	1
Lulette (Ransch)	2
Redan (McNichols)	3

Time—1:01½.

RACE NO. 28—RUNNING.

For four-year-olds and over. One and one sixteenth miles. Selling. Purse, $225; of which $40 to second and $15 to third. All to carry 112 lbs. Winner to be sold for $200.

1. E. B. Smith's b. g. Sea Spray (a), by Mariner—Marinette; 112 lbs.
2. J. S. Campbell's b. g. El Mido (5), by Sir Modred—Ethel; 112 lbs.
3. Lone Stable's ch. h. Cromwell (a), by St. Blaise—Flavina; 112 lbs.
4. J. Coffey's ch. h. Jim McCleevy (5), by Linden—Verbena; 112 lbs.
5. J. Weber's b. m. Lizzella (a), by Morello—Lizzie Dunbar; 109 lbs.
6. P. Moore's ch. m. Alicia (a), by Malcolm—Viney; 109 lbs.
7. G. Miller's b. g. Decoy (4), by Imp. Deceiver—Nantucket; 112 lbs.
8. H. Whitman's b. g. Whaleback (5), by Imp. Duncombe—Orange Leaf; 112 lbs.
9. F. D. Weir's ch. g. Merops (5), by Brutus—Merope; 112 lbs.
10. B. F. Hobart's ch. g. Limber Jim (a), by Snuff-Box—Mildred; 112 lbs.

SUMMARY.

Cromwell (Russell)	1
Limber Jim (Hobart)	2
Whaleback (Burlingame)	3

Time—1:49.

RACE NO. 29—RUNNING.

For maiden two-year-olds. Five furlongs. Purse, $225; of which $40 to second and $15 to third. 5 lbs. below the scale. Horses beaten three or more times allowed 5 lbs.; and if they have not been placed second or third, 5 lbs. additional.

1. Neil & Mackey's ch. c. Charette (2), by Imp. Crighton—Tatina; 100 lbs.
2. F. Burke's b. g. Wandering Boy (2), by Brutus—Wandering Nun of Argyle; 103 lbs.
3. W. D. Sink, Jr.'s b. g. Dawson (2), by Maxio—Easter; 105 lbs.
4. P. Moore's b. f. Isar (2), by Foul Shot or Little Minch—Virgie D; 100 lbs.
5. J. S. Campbell's ch. g. Resin (2), by Emperor of Norfolk—Espiritu Santa; 103 lbs.
6. J. L. Clayton & Co.'s ch. c. Senator Bruce (2), by Amigo—Indianola; 108 lbs.
7. J. McGovern's b. f. Mariosa (2), by Imp. Mariner—Shannon Rose; 110 lbs.

SUMMARY.

Dawson (Logue)	1
Wandering Boy (Howson)	2
Senator Bruce (Bozeman)	3

Time—1:02.

RACE NO. 30—RUNNING.

For three-year-olds and over, beaten non-winners at this meeting that have not won two races in 1901. Six furlongs. Selling. Purse, $225; of which $40 to second and $15 to third; 10 lbs. below the scale. Winner to be sold for $200.

1. Thomas Latta's b. g. Pongo (6), by El Rio Rey—Ogalena; 112 lbs.
2. T. Rector's ch. m. Mountain Dew (5), by Blazes—Alice B; 109 lbs.
3. Owen Bros.' ch. f. Conejo (4), by Royal Flush—Lady Emma; 109 lbs.
4. Charles Earl's b. m. Coming Event (4), by Imp. Calvados—Katrinka; 109 lbs.
5. William Cahill's br. c. Lief Prince (3), by Prince Lief or Bermuda—Natalie; 106 lbs.
6. W. B. Jennings's ch. g. Canderos (4), by Candlemas—Hinda Dwyer; 112 lbs.
7. E. G. McConnell's ch. m. Lost Girl (5), by Sobrante—Nellie K; 109 lbs.
8. J. D. Dunn's br. g. Pegalong (3), Imp. Crighton—Sweet Peggy; 106 lbs.

SUMMARY.

Coming Event (Ross)	1
Canderos (Ransch)	2
Lost Girl (Russell)	3

Time—1:14¾.

SATURDAY, SEPTEMBER 7, 1901.

RACE NO. 31—PACING.

2:17 class. Purse, $800. Mile heats, three in five.

1. Vendome Stock Farm's (San José) ch. m. Our Boy's Sister, by Baywood—by Wapsie.
2. G. Trank's (Chico) b g. Harry J, by Reavis's Steinway—Jennie June.
3. W. G. Layng's (San Francisco) b. g. Sir Albert S, by Diablo—Effie Logan.
4. Ed. Kavanaugh's (Vallejo) ch. h. Gaff Topsail, by Diablo—Belle.
5. J. A. Lafferty's (Oakland) br. h. Advertisor, by Advertiser—by Steinway.
6. Ed. Graser's (Riverside) ch. m. Nellie I, by Gossiper.
7. C. W. Whitehead's (Stockton) ch. g. Toppy, by Delphi—Sister to Astor.
8. R. Freeman's (Red Bluff) b. m. Banker's Daughter, by Arthur Wilkes—Sunflower.
9. A. M. Leeper's (Reno) b. g. Wilfred L, by Bozero—Lady H.
10. N. D. Harrison's (Los Angeles) br. m. Little Maid, by Rockwood—by Hambletonian Mambrino.
11. W. Vanderhurst's (Salinas) b. m. Diablita, by Diablo.
12. Valencia Stock Farm's (Los Angeles) br. h. Direct Heir, by Direct—Bet Madison.
13. J. H. Thompson's (Riverside) ch. g. El Diablo, by Diablo—Elwood.

SUMMARY.

Sir Albert S (J. Groom)	1	1	1
El Diablo (C. Farrar)	2	2	2
Our Boy's Sister (C. F. Bunch)	3	3	3
Gaff Topsail (J. Smith)	4	4	dis.
Diablita (J. Dwain)	5	dis.	

Time—2:11½, 2:10¾, 2:10¼.

RACE NO. 31A—RUNNING.

Six furlongs. Selling. Purse, $225; of which $40 to second and $15 to third. Winner to be sold for $300.

1. T. E. McLaughlin's ch. g. Mike Rice (a), by J. H. Fenton—Mrs. McAllister; 115 lbs.
2. E. G. McConnell's ch. m. Lost Girl (a), by Sobrante—Nellie K; 105 lbs.
3. E. Carey's b. f. Catherine Bravo (3), by Rio Bravo—Catherine B; 102 lbs.
4. J. S. Campbell's b. g. Burdock (4), by Matt Byrnes—Alva Daly; 102 lbs.
5. J. L. Rector's ch. m. Lou Clievden (4), by Imp. Clievden—Miss Lou; 100 lbs.
6. W. B. Jennings & Co.'s b. c. Lapidus (2), by Imp. Star Ruby—Pearl V; 100 lbs.
7. J. Webb's br. g. San Augustine (5), by Emperor of Norfolk—The Hook Blind; 100 lbs.
8. P. Donalache's b. c. Sol (2), by Imp. Trentola—Ursula; 90 lbs.
9. P. E. Smith's b. m. Little Sister (a), by Imp. Friar Tuck—Lowland Lass; 90 lbs.
10. D. F. Cox's b. m. Clarando (5), by Clarandon—Voltande; 108 lbs.

SUMMARY.

Lapidus (Ransch)	1
Lou Clievden (Howson)	2
Burdock (Ashley)	3

Time—1:14½.

RACE NO. 32—RUNNING.

For three-year-olds and over. Six furlongs. Purse, $250; of which $40 to second and $20 to third. Winner to be sold for $600; if for less, 3 lbs. allowed on each $100 down to $200. Beaten non-winners at this meeting allowed 5 lbs.

1. F. D. Weir's b. f. Mike Strauss (4), by Iroquois—Gypsy; 105 lbs.
2. G. Burger's b. f. Mamie Hildreth (3), by Thornhill—Mamie H; 96 lbs.
3. J. Martin, Jr.'s b. m. Phlegon (4), by Imp. Piccolo—Little Rose; 105 lbs.
4. W. L. Stanfield's br. m. Kitty Kelly (4), by Apache—Playtoy; 102 lbs.
5. C. Young's ch. f. Eonic (3), by Eon—Mermaid; 99 lbs.
6. P. Crowley's br. m. Gusto (4), by Brutus—Irish Lass; 105 lbs.

SUMMARY.

Eonic (Ransch)	1
Mamie Hildreth (Howson)	2
Mike Strauss (McDermott)	3

Time—1:14¾.

RACE NO. 33—RUNNING.

Vinctor Stake; for three-year-olds and over. One mile. Entrance $10, to accompany nomination; $20 additional for horses not declared by 4 p. m. day preceding race; with $400 added by the Society, of which $70 to second and $30 to third. Stake to be named after winner if Vinctor's time (1:40) is beaten. A non-winner of a stake race in 1901, or a race of the value of $500, allowed, if a non-winner of five races other than selling races, 5 lbs. Maidens, 7 lbs. additional. Closed with 14 entries. Total value, $650.

1. W. B. Jennings & Co.'s b. m. Andrisa (4), by Imp. St. Andrew—Fanny Louise; 114 lbs.
2. R. Wilson's ch. g. Byron Rose (3), by Ducat—Rose Magenta; 107 lbs.
3. W. B. Jennings & Co.'s b. h. Vesuvian (4), by St. Andrew—Hot Springs; 122 lbs.
4. T. J. Fields's b. g. Rey Dare (3), by El Rio Rey—Lady Dare; 107 lbs.
5. L. A. Blasingame's b. g. Grafter (3), by Cicero—Leapyear; 107 lbs.
6. P. Donalache's b. c. Wardman (3), by Tammany—Belinda; 107 lbs.

SUMMARY.

Vesuvian (Ransch)	1
Byron Rose (Logue)	2
Rey Dare (Russell)	3

Time—1:42.

RACE NO. 34—RUNNING.

Futurity Stake; for foals of 1899. Six furlongs. $1,000 added. Closed with 31 entries, of which 8 were refunded. Total value of stake, $2,250.

1. J. Weber & Co.'s b. f. Torso Maid (2), by Torso—Happy Maiden; 115 lbs.
2. W. B. Sink, Jr.'s b. c. Royalty (2), by Imp. Cavalier—Empress of Norfolk; 115 lbs.
3. G. Summers & Co.'s br. g. Water Scratch (2), by Imp. Water Cress—Helen Scratch; 118 lbs.
4. Burns & Waterhouse's b. f. Doreen (2), by Torso—Decoy Duck; 115 lbs.
5. A. J. Stemler's b. f. Divina (2), by Bassetlaw—Angelique; 115 lbs.

SUMMARY.

Divina (Russell)	1
Water Scratch (Foucon)	2
Doreen (Ransch)	3

Time—1:14.

RACE NO. 34A—RUNNING.

Handicap for all ages. Five furlongs Selling. Purse, $200; of which $20 to second and $10 to third.

1. J. Whalen's b. m. Swiftwater (4), by Imp. Candlemas—Repleta; 105 lbs.
2. H. Whiteman's ch. g. Fine Shot (4), by Balgowan—Dignity; 105 lbs.
3. P. Moore's b. g. First Shot (4), by Imp. Foul Shot—Gratitude; 105 lbs.
4. H. L. Haskell's ch. g. Gold Baron (5), by Imp. Rayon d'Or—Ballerina; 105 lbs.
5. E. B. Smith's b. g. Sea Spray (a), by Imp. Mariner—Marinette; 105 lbs.
6. J. D. Dunn's br. g. Pegalong (3), by Imp. Crighton—Sweet Peggy; 99 lbs.
7. T. Rector's ch. m. Mountain Dew (5), by Blazes—Alice D; 105 lbs.
8. P. E. Smith's ch. m. Nettie Clark (4), by Rio Bravo—Apollinaris; 105 lbs.
9. Frank Allen's b. m. Blue Bell (a), by Prince of Norfolk—Gem of the Mountains; 105 lbs.
10. L. Tryon's b. m. Galene (4), by Imp. Brutus—Picnic; 105 lbs.
11. Murray & Collins's ch. g. Toribio (6), by Apache—Marion; 105 lbs.

SUMMARY.

Fine Shot (Burlingame)	1
Toribio (Russell)	2
First Shot (Ransch)	3

Time—1:01¼.

RACE NO. 35—RUNNING.

For four-year-olds and over. One and one sixteenth miles. Selling. Purse, $250; of which $40 to second and $20 to third. Winner to be sold for $700; if for less, 3 lbs. on each $100 down to $400; then 5 lbs. on each $100 down to $100. A winner of four races in 1901 not to be entered for less than $400.

1. P. Moore's ch. f. Alicia (a), by Malcolm—Viney; 95 lbs.
2. P. Sheridan's ch. g. Frank Duffy (4), by Montana—Josephine; 103 lbs.

3. J. McGovern's ch. m. Torsida (6), by Torso—Judith; 105 lbs.
4. Walter Maben's b. m. Miss Vera (4), by Amigo S—Fame; 100 lbs.
5. B. Hobart's b. g. Pilot (4), by Morello—Adelaide; 100 lbs.
6. Wm. Cahill's b. g. Rinaldo (6), by Leonatus—Dahlia; 98 lbs.

SUMMARY.

Torsida (Russell)	1
Pilot (Burlingame)	2
Miss Vera (Howson)	3

Time—1:48¼.

MONDAY, SEPTEMBER 9, 1901.

RACE NO. 36—TROTTING.

The Stanford Stakes for 1901; for foals of 1898. Mile heats, three in five. Entries closed May 15, 1899. $50 entrance, of which $5 accompanied nomination May 15, 1899; $5 January 1, 1900; $10 January 1, 1901; $10 July 1, 1901, and $20 on the tenth day before the first day of the State Fair of 1901. $300 added by the Society. The stakes and added money to be divided 50, 25, 15, and 10 per cent. Total value, $1,260.

1. W. Hogoboom's (Marysville) br. c. Charles H, by Lynmont—Elmorene.
2. P. W. Lee's (Oakland) br. f. Fluey, by Or Lee—Fleety.
3. Thomas S. Manning's (Avalon) b. c. Commander Muckle, by McKinney—Cheerful.
4. J. Doran's (Oakland) b. f. Della McCarty, by McKinney—Lady C.
5. C. A. Owen's (Fresno) ch. c. Lee Roy, by Waldstein—Zadie McGregor.
6. Santa Rosa Stock Farm's (Santa Rosa) blk. f. Almareta, by L. W. Russell—Flora Allen.
7. Santa Rosa Stock Farm's (Santa Rosa) b. f. Lady Russell, by L. W. Russell—Pansy.

SUMMARY.

Almareta (G. Ramage)	1	1	1
Della McCarty (J. Doran)	4	2	2
Commander Muckle (F. Ward)	2	3	4
Charles H (W. Hogoboom)	5	4	3
Lee Roy (C. A. Owen)	3	5	dis.
Fluey (P. W. Lee)	dis.		

Time—2:28¾, 2:27, 2:26.

RACE NO. 37—TROTTING.

Purse, $400. Mile heats, three in five.

1. I. Mulholland's (Independence) b. g. Osito, by McKinney—Twilight.
2. G. F. Anderson's (San José) b. g. Cladius, by Nutwood Wilkes—Fannie Menlo.
3. S. A. Hooper's (Yountville) b. h. Alta Vela, by Electioneer—Lorita.
4. T. J. Crowley's (San Francisco) b. h. Boydello, by Boydell—by Durango Chief.
5. L. M. Clark's (Sacramento) b. h. Ouiboul, by Stamboul—Ouida.

SUMMARY.

Claudius (T. Barstow)	1	1	1
Osito (I. Mulholland)	2	2	2
Alta Vela (S. A. Hooper)	4	3	4
Ouiboul (L. M. Clark)	3	4	5
Boydello (E. Lafferty)	5	5	3

Time—2:16¼, 2:16½, 2:18.

RACE NO. 38—RUNNING.

For four-year-olds and over, non-winners of five races in 1901. Seven and one half furlongs. Selling. Purse, $250; of which $40 to second and $20 to third. Winner to be sold for $600; if for less, 4 lbs. on each $100 down to $200. Beaten non-winners since June 10th, allowed 5 lbs.

1. B. F. Hobart's ch. g. Limber Jim (a), by Snuff-Box—Mildred; 118 lbs.
2. F. D. Weir's ch. g. Merops (5), by Brutus—Merope; 105 lbs.
3. Walter Maben's b. m. Miss Vera (4), by Amigo—Fame; 103 lbs.
4. J. A. Gibson's br. g. J. Boggs (4), by Imp. Friar Tuck—Czarina; 110 lbs.

5. J. S. Campbell's b. g. Burdock (4), by Imp. Matt Byrnes—Alva Daly; 106 lbs.
6. Charles Earl's b. m. Coming Event (4), by Imp. Calvados—Katrinka; 103 lbs.

SUMMARY.

Merops (Hoar)	1
Coming Event (Ross)	2
Miss Vera (Burlingame)	3

Time—1:34¾.

RACE NO. 39—RUNNING.

For three-year-olds and over. One mile. Selling. Purse, $250; of which $40 to second and $20 to third. Three-year-olds to carry 106 lbs.; four-year-olds and over, 112 lbs. All to be sold for $100.

1. George Miller's b. g. Decoy (4), by Imp. Deceiver—Nantucket; 112 lbs.
2. J. Coffey's ch. h. Jim McCleevy (5), by Linden—Verbena; 112 lbs.
3. D. Morgan's b. g. McFarlane (6), by Imp. Mariner—Moonlight; 112 lbs.
4. H. Whitman's b. g. Whaleback (5), by Imp. Duncombe—Orange Leaf; 112 lbs.
5. Wm. Cahill's b. g. Rinaldo (6), by Leonatus—Dahlia; 112 lbs.
6. Miss M. O'Connell's ch. g. Boardman (5), by St. Charles or Willful—Rosewood; 112 lbs.
7. J. S. Campbell's b. g. El Mido (5), by Sir Modred—Ethel; 112 lbs.

SUMMARY.

Whaleback (Burlingame)	1
Jim McCleevy (Ransch)	2
Rinaldo (Hoar)	3

Time—1:42¼.

RACE NO. 40—RUNNING.

For two-year-olds that have not won two races in 1901. Five furlongs. Selling. Purse, $225; of which $40 to second and $15 to third. 5 lbs. below scale. Non-winners of a race allowed 5 lbs.; if beaten at this meeting, 5 lbs. additional. Winner to be sold for $300.

1. G. W. Snider & Co.'s ch. f. Quadra (2), by Imp. Prestonpans—Miss Belinda; 110 lbs.
2. W. B. Jennings & Co.'s b. f. Lulette (2), by Bassetlaw—Lulu; 100 lbs.
3. S. F. Clapp's b. c. Gypsy Boy (2), by Imp. True Briton—Gypsy Girl; 108 lbs.
4. La Siesta Ranch's b. g. Wandering Boy (2), by Brutus—Wandering Nun of Argyle; 103 lbs.
5. J. Coffey's ch. f. Evea G (2), by Imp. Juvenal—Sister Geneva; 110 lbs.
6. F. D. Weir's br. f. Flattered (2), by Emperor—Flattery; 105 lbs.
7. L. A. Blasingame's b. c. Porous (2), by Wernberg—Chevy Chase; 113 lbs.
8. W. B. Sink Jr.'s b. c. Dawson (2), by Maxio—Easter; 113 lbs.
9. G. Summers & Co.'s ch. g. Rubina (2), by Imp. Star Ruby—Torsina; 113 lbs.
10. Lone Stable's b. f. Yankee Dame (2), by Yankee Doodle—Dame Majorie; 100 lbs.

SUMMARY.

Lulette (Ransch)	1
Evea G (Tullett)	2
Quadra (Russell)	3

Time—1:02.

RACE NO. 41—RUNNING.

For three-year-olds and over, beaten non-winners at this meeting. Six furlongs. Selling. Purse, $225; of which $40 to second and $15 to third. Three-year-olds to carry 109 lbs.; four-year-olds and over, 112 lbs. Winner to be sold for $200.

1. E. Kaufman's ch. m. Katie Walcott (4), by Prince Royal—Penelope; 109 lbs.
2. L. Tryon's b. m. Galene (4), by Imp. Brutus—Picnic; 112 lbs.
3. F. D. Weir's br. g. Mike Strauss (4), by Iroquois—Gypsy; 112 lbs.
4. C. W. Carroll's b. f. Artilla (4), by Artillery—Duchess of Towers; 109 lbs.
5. W. B. Jennings & Co.'s ch. g. Canderos (4), by Candlemas—Hinda Dwyer; 112 lbs.

6. G. W. Snider & Co.'s ch. m. Vantine (4), by Imp. Anchorite—Vestina; 109 lbs.
7. John Lodge's br. f. Little Gun (3), by Imp. Artillery—Queen Kapiolani; 109 lbs.

SUMMARY.

Mike Strauss (Hoar)	1
Vantine (Russell)	2
Artilla (Burlingame)	3

Time—1:15.

TUESDAY, SEPTEMBER 10, 1901.

RACE NO. 42—TROTTING.

2:15 class. Purse, $400. Mile heats, three in five.

1. J. Depoister's (Los Angeles) br. g. Peter Jackson, by Designer—by Abbottsford.
2. J. Cincello's (San Francisco) br. g. Puerto Rico, by Sable Wilkes—Mamie Kohl.
3. Vendome Stock Farm's (San José) s. g. Thomas R, by Iran Alto—Yadrel.
4. John Quinn's (Santa Rosa) blk. h. Black Bart, by Robin—by Williamson's Belmont.
5. G. W. Kingsbury's (San Francisco) r. g. Lynall, by Lynmont—Balance All.
6. G. F. Jacobs's (Nevada City) br. g. Walling, by Waldstein—by Pasha.

SUMMARY.

Thomas R. (C. F. Bunch)	2	1	1	1
Lynall (G. W. Kingsbury)	1	5	3	2
Puerto Rico (J. Cincello)	3	2	2 r. o.	
Black Bart (J. Quinn)	5	3	4 r. o.	
Walling (J. Dwain)	4	4	5 r. o.	
Peter Jackson (J. Depoister)	6	6	6 r. o.	

Time—2:25, 2:20¾, 2:19, 2:25¼.

RACE NO. 43—TROTTING.

Road race for members of the Sacramento Driving Club. Mile heats, three in five.

1. F. E. Wright's (Sacramento) br. h. Baby Button, by Alexander Button—Algerine.
2. L. S. Upson's (Sacramento) br. m. Regina F, by Alto Rex—by Nephew.
3. F. Ruhstaller, Jr.'s (Sacramento) b. g. Monroe B, by Monroe.
4. Charles Paine's (Sacramento) b. g. Pio, by Fern—Sunflower.
5. Wm. Trust's (Sacramento) br. g. Candy Joe, by Berlin.

SUMMARY.

Monroe B (F. Ruhstaller, Jr.)	2	1	1	1
Regina F (L. S. Upson)	1	2	2	2
Pio (C. Paine)	3	3	3	3
Baby Button (F. E. Wright)	4	4	4	4
Candy Joe (Wm. Trust)	dis.			

Time—2:22, 2:19¾, 2:23¼, 2:23.

RACE NO. 44—RUNNING.

For two-year-olds that have not won at this meeting. Five furlongs. Selling. Purse, $225; of which $40 to second and $15 to third. Winner to be sold for $700; if for less, 2 lbs. on each $100 down to $200. Horses beaten at this meeting and not placed second, allowed 3 lbs.; not placed third, 5 lbs.

1. Lone Stable's ch. g. Colonel Smith (2), by Thornhill—Tillie S; 103 lbs.
2. G. Summers & Co.'s b. g. Tyrannus (2), by Imp. Star Ruby—Tyranny; 108 lbs.
3. J. A. Weber's br. f. Torso Maid (2), by Torso—Happy Maiden; 102 lbs.
4. J. P. Atkin's b. g. Jarretiere d'Or (2), by Golden Garter—Ricardo; 114 lbs.
5. W. B. Sink, Jr.'s br. g. Royalty (2), by Imp. Cavalier—Empress of Norfolk; 105 lbs.

SUMMARY.

Jarretiere d'Or (Ruiz)	1
Tyrannus (Hoar)	2
Royalty (Howson)	3

Time—1:01½.

RACE NO. 45—RUNNING.

For three-year-olds and over, beaten non-winners at this meeting. One and one sixteenth miles. Selling. Three-year-olds to carry 105 lbs.; four-year-olds and over, 112 lbs. 3 lbs. allowed for each time beaten at this meeting; if beaten two or more times and not placed second or third, allowed 5 lbs. additional. Winner to be sold for $200.

1. P. Sheridan's ch. g. Frank Duffy (4), by Malcolm—Viney; 109 lbs.
2. C. W. Carroll's b. f. Artilla (4), by Artillery—Duchess of Towers; 109 lbs.
3. J. Coffey's ch. g. Galanthus (3), by July—Snowdrop; 94 lbs.
4. B. S. Hobart's b. g. Pilot (4), by Morello—Adelaide; 109 lbs.
5. Wm. Cahill's b. g. Rinaldo (6), by Leonatus—Dahlia; 103 lbs.
6. E. G. McConnell's ch. m. Lost Girl (5), by Sobrante—Nellie K; 100 lbs.
7. Lone Stable's br. g. Casdale (5), by Favordale—Castalia; 101 lbs.
8. T. Kelly's ch. m. Castaine (5), by Eotheon—Pearlfinder; 109 lbs.
9. J. Weber's b. m. Lizzella (a), by Morello—Lizzie Dunbar; 109 lbs.
10. P. Moore's ch. f. Alicia (a), by Malcolm—Viney; 98 lbs.

SUMMARY.

Alicia (Ransch)	1
Lizzella (Ruiz)	2
Galanthus (Hall)	3

Time—1:48¾.

RACE NO. 46—RUNNING.

Special. One mile. Purse, $400; of which $70 to second and $30 to third.

1. Burns & Waterhouse's b. g. Scotch Plaid (6), by Imp. Midlothian—Mottle; 105 lbs.
2. Owen Bros.' b. f. Flush of Gold (3), by Royal Flush—Gold Cup; 104 lbs.
3. G. Miller's br. c. Sir Hampton (4), by Water Cress—Imp. Lizzie Hampton; 107 lbs.
4. T. J. Field's b. g. Rey Dare (3), by El Rio Rey—Lady Dare; 92 lbs.
5. R. Wilson's ch. g. Byron Rose (3), by Ducat—Rose Magenta; 92 lbs.

SUMMARY.

Flush of Gold (Logue)	1
Scotch Plaid (Ransch)	2
Sir Hampton (Russell)	3

Time—1:40.

RACE NO. 47—RUNNING.

For three-year-olds and over that have not won three races at this meeting. Six furlongs. Selling. Purse, $225; of which $40 to second and $15 to third. Three-year-olds to carry 109 lbs.; four-year-olds and over, 112 lbs. Those beaten and not placed second or third, allowed 3 lbs. for each time beaten at this meeting. Winner to be sold for $200.

1. W. P. Hayes's b. g. Ravino (3), by Racine—Precious; 109 lbs.
2. T. E. McLaughlin's ch. g. Mike Rice (a), by J. H. Fenton—Mrs. McAllister; 106 lbs.
3. Burns & Waterhouse's ch. g. Rollick (3), by Take Notice—Happy Maiden; 109 lbs.
4. R. E. Dolan's ch. g. Howard (a), by Tyrant—Mayetta; 112 lbs.
5. P. Moore's b. g. First Shot (4), by Foul Shot—Gratitude; 112 lbs.
6. P. Sullivan's b. g. Almoner (5), by Midlothian—Charity; 112 lbs.
7. Wm. Cahill's b. g. Prestidigitator (4), by Russell—Active; 109 lbs.

SUMMARY.

Rollick (Ransch)	1
Mike Rice (Tullett)	2
Prestidigitator (Hoar)	3

Time—1:14¾.

RACE NO. 47A—RUNNING.

For all ages, beaten non-winners at this meeting. Five furlongs. Selling. Purse, $200; of which $40 to second and $15 to third. Two-year-olds to carry 97 lbs.; three-year-olds, 110 lbs.; four-year-olds and over, 115 lbs. Those beaten two or more times and not placed second, allowed 5 lbs. All to be sold for $100.

1. F. Allen's b. m. Blue Bell (4), by Prince of Norfolk—Gem of the Mountains; 107 lbs.
2. E. Carey's b. f. Catherine Bravo (3), by Rio Bravo—Catherine B; 102 lbs.

3. L. Tryon's b. m. Galene (4), by Imp. Brutus—Picnic; 107 lbs.
4. H. Haskell's ch. g. Gold Baron (5), by Imp. Rayon d'Or—Ballerina; 110 lbs.
5. F. S. Capps's ch. c. Gypsy Boy (2), by Imp. True Briton—Gypsy Girl; 92 lbs.
6. W. B. Jennings & Co.'s ch. g. Canderos (4), by Candlemas—Hinda Dwyer; 115 lbs.
7. D. F. Cox's b. m. Clarando (5), by Clarandon—Voltando; 107 lbs.
8. T. Rector's ch. m. Mountain Dew (5), by Blazes—Alice D; 106 lbs.
9. C. W. Carroll's b. f. Chaste (3), by Jim Gore—Imp. British Blue Blood; 107 lbs.

SUMMARY.

Clarando (Russell)	1
Canderos (Ransch)	2
Catherine Bravo (Logue)	3

Time—1:01.

WEDNESDAY, SEPTEMBER 11, 1901.

Race No. 48—Pacing.

2:25 class. Purse, $800. Mile heats, three in five.

1. Vendome Stock Farm's (San José) b. m. China Maid, by McKinney—by Onward.
2. Santa Rosa Stock Farm's (Santa Rosa) ch. g. B. S. Dillon, by Sydney Dillon—Biscara.
3. Valencia Stock Farm's (Los Angeles) br. g. Direct Heir, by Direct—Bet Madison.
4. W. S. Maben's (Los Angeles) b. m. Electra, by Silkwood—by Woolsey.
5. George Trank's (Chico) b. g. Harry J, by Reavis's Steinway—Jennie June.
6. Reidy & Johnson's (Red Bluff) br. m. Celmar, by Falrose—by Killarney.
7. J. A. Lafferty's (Oakland) br. h. Advertisor, by Advertiser—by Steinway.
8. Ed. Graser's (Riverside) ch. m. Nellie I, by Gossiper.
9. C. W. Whitehead's (Stockton) ch. g. Toppy, by Delphi—Sister to Astor.
10. R. Freeman's (Red Bluff) b. m. Banker's Daughter, by Arthur Wilkes—Sunflower.
11. T. C. Cabney's (Eureka) b. g. Al Sandy, by Wayland W—by Overland.
12. A. M. Leeper's (Reno) br. g. Wilfred L, by Bozero—Lady H.
13. W. Vanderhurst's (Salinas) b. f. Diablita, by Diablo.
14. John Donahue's (Riverside) blk. g. Midnight, by Nutford—by Grandee.

SUMMARY.

Toppy (C. Whitehead)	3	1	1	1
Banker's Daughter (Wm. Brown)	1	3	4	2
Midnight (D. Donahue)	2	2	2 r. o.	
Harry J (W. Donathan)	4	5	3 r. o.	
Diablita (J. Dwain)	6	4	6 r. o.	
Wilfred L (R. C. Leeper)	5	6	5 r. o.	

Time—2:13¾, 2:16, 2:16¼, 2:20.

Race No. 49—Trotting.

2:24 class. Purse, $500. Mile heats, three in five.

1. C. Denison's (University) blk. h. McKenna, by McKinney—Etta Wilkes.
2. D. F. Oglesby's (Carpenteria) b. h. Almonada, by Eros—by Nutwood.
3. R. Freeman's (Red Bluff) b. g. Prince L, by Escort—Queen L.
4. Vendome Stock Farm's (San José) b. m. Nora McKinney, by McKinney—by Dexter Prince.
5. S. J. Dunlop's (Los Angeles) b. m. Lucy G, by Junio—Lottie.

SUMMARY.

Nora McKinney (C. F. Bunch)	1	1	2	1
McKenna (F. Ward)	4	4	1	2
Prince L (William Brown)	3	2	3 r.o.	
Almonada (Delaney)	2	3	4 r.o.	

Time—2:17¾, 2:18½, 2:18¾, 2:21.

Race No. 50—Running.

For maiden two-year-olds. Five furlongs. Selling. Purse, $225; of which $40 to second and $15 to third. 10 lbs. below the scale. Horses that have not been placed one, two, three, allowed 5 lbs. Winner to be sold for $200.

1. G. W. Snider's b. f. Mariosa (2), by Imp. Mariner—Shannon Rose; 100 lbs.
2. Neil & Mackey's ch. c. Charette (2), by Imp. Crighton or Eolo—Fatina; 103 lbs.

3. Lone Stable's b. f. Yankee Dame (2), by Yankee Doodle—Dame Marjorie; 100 lbs.
4. F. D. Weir's b. f. Flattered (2), by Emperor—Flattery; 105 lbs.
5. R. Hughes's ch. f. Jennie Hughes (2), by Racine—Aurelia II; 100 lbs.
6. Thomas Fox's ch. c. George Clark (2), by Torso—City Girl; 103 lbs.

SUMMARY.

George Clark (Russell)	1
Flattered (Hoar)	2
Jennie Hughes (Logue)	3

Time—1:02¾.

Race No. 51—Running.

For three-year-olds and upward, non-winners of two races this year. Six furlongs. 10 lbs. below the scale. Non-winners that have started three or more times and have not been placed third, allowed 7 lbs. All to be sold for $200.

1. Wm. Cahill's br. c Lief Prince (3), by Prince Lief or Bermuda—Natalie; 106 lbs.
2. P. E. Smith's b. m. Little Sister (a), by Imp. Friar Tuck—Lowland Lass; 102 lbs.
3. E. G. McConnell's ch. m. Lost Girl (5), by Sobrante—Nellie K; 109 lbs.
4. R. E. Dolan's ch. g. Howard (a), by Tyrant—Mayetta; 112 lbs.
5. T. Rector's ch. m. Mountain Dew (4), by Blazes—Alice B; 109 lbs.
6. M. Kane's b. g. Rio Colorado (4), by Rio Bravo—Commotion; 112 lbs.
7. J. Webb's br. g. San Augustine (5), by Emperor of Norfolk—The Hook Blind; 112 lbs.
8. G. L. Richards's blk. m. Pidalia (4), by Idalium—Piquant; 102 lbs.

SUMMARY.

Little Sister (Hoar)	1
San Augustine (Gaffney)	2
Pidalia (Howson)	3

Time—1:15.

Race No. 52—Running.

For three-year-olds and over Seven and one half furlongs. Selling. Purse, $250; of which $40 to second and $20 to third. Three-year-olds to carry 107 lbs.; four-year-olds and over, 112 lbs. Winner to be sold for $200.

1. Lone Stable's ch. g. Cromwell (a), by St. Blaise—Flavina; 112 lbs.
2. G. Burger's b. f. Mamie Hildreth (3), by Thornhill—Mamie H; 103 lbs.
3. F. D. Weir's ch g. Merops (5), by Brutus—Merope; 112 lbs.
4. D. Morgan's br. g. McFarlane (a), by Imp. Mariner—Moonlight; 112 lbs.
5. P. Donalache's b. c. Wardman (3), by Tammany—Belinda; 107 lbs.
6. Charles Earl's b. m. Coming Event (4), by Imp. Calvados—Katrinka; 109 lbs.

SUMMARY.

Coming Event (Ross)	1
Merops (Hoar)	2
Mamie Hildreth (Howson)	3

Cromwell left at post.

Time—1:34¼.

Race No. 53—Running.

For two-year-olds, non-winners of two races. Five furlongs. Purse, $225; of which $40 to second and $15 to third. Maidens allowed 5 lbs. If beaten at this meeting, 5 lbs. additional.

1. J. L. Clayton & Co.'s ch. c. Senator Bruce (2), by Amigo—Indianola; 108 lbs.
2. W. B. Sink, Jr.'s br. g. Royalty (2), by Imp. Cavalier—Empress of Norfolk; 118 lbs.
3. P. Guilfoyle's ch. g. Redan (2), by Imp. Artillery—Princess Noretta; 108 lbs.
4. P. Smith's ch. g. Fred Atterbury (2), by Bowling Green—Kittie Waddle; 108 lbs.
5. P. Donalache's b. g. Sol (2), by Imp. Trentola—Ursula; 118 lbs.
6. W. B. Jennings & Co.'s b. f. Lulette (2), by Bassetlaw—Lulu; 115 lbs.
7. G. Summers & Co.'s ch. g. Rubina (2), by Imp. Star Ruby—Torsina; 118 lbs.

SUMMARY.

Royalty (Ruiz)	1
Redan (McNichols)	2
Lulette (Ransch)	3

Time—1:01¾.

THURSDAY, SEPTEMBER 12, 1901.

Race No. 54—Pacing.

2:13 class. Purse, $1,000. Mile heats, three in five.

1. H. M. Dunlap's (San Francisco) b. g. King Cadenza, by Steinway—Empress.
2. Wm. G. Layng's (San Francisco) b. g. Sir Albert S, by Diablo—Effie Logan.
3. Ed. Kavanaugh's (Vallejo) ch. h. Gaff Topsail, by Diablo—Belle.
4. Ed. Graser's (Riverside) ch. m. Nellie I, by Gossiper.
5. C. W. Whitehead's (Stockton) blk. h. Delphi, by Director—Etta.
6. J. D. Heines's (San Francisco) br. h. John A, by Wayland W—Lady Moor.
7. S. C. Tryon & Co.'s (Sacramento) blk. m. Margaretta, by Direct—Rosetta A.
8. R. R. Brown's (Oakland) b. g. Doc Wilkes, by Mambrino Wilkes.
9. J. B. Iverson's (Salinas) ch. m. Dictatress, by Dictatus—Salinas Belle.
10. C. W. Main's (Corona) b. m. Queen R, by Redondo—by Adrian Wilkes.
11. J. H. Thompson's (Santa Ana) ch. g. El Diablo, by Diablo—Elwood.
12. J. A. Lafferty's (Oakland) br. h. Advertisor, by Advertiser—by Steinway.

SUMMARY.

Sir Albert S (J. Groom)	1	1	1
El Diablo (C. Farrar)	2	2	2
Margaretta (E. Lafferty)	3	3	4
Dictatress (J. H. Vance)	6	4	3
John A (W. Masten)	4	7	7
Doc Wilkes (H. D. Brown)	7	5	5
Gaff Topsail (J. Smith)	5	6	6
Queen R (F. E. Ward)	8	8	dis.

Time—2:10½, 2:12½, 2:09¾.

Race No. 55—Pacing.

Special. Purse, $400. Mile heats, three in five.

1. H. Brown's (Oakland) b. m. Miramonte, by Diablo.
2. E. B. Smith's (Reno) b. g. Deacon.
3. J. Donohue's (San Bernardino) b. h. Richard B, by Woolsey—by Ten Broeck.
4. J. D. Heines's (San Francisco) b. g. Penrose, by Falrose—by Brigadier.
5. Vendome Stock Farm (San José) ch. m. Our Boy's Sister, by Baywood—Wapsie.

SUMMARY.

Richard B (D. Donohue)	3	1	1	1
Penrose (W. Masten)	2	2	2	r. o.
Our Boy's Sister (C. F. Bunch)	1	dis.		
Miramonte (H. D. Brown)	dis.			
Deacon (E. B. Smith)	dis.			

Time—2:16, 2:17¼, 2:18¼, 3:10.

Race No. 56—Running.

For three-year-olds and over. Seven and one half furlongs. Selling. Purse, $225; of which $40 to second and $15 to third. Beaten non-winners at this meeting allowed 3 lbs. for each time beaten; and if not placed second or third, an additional allowance of 5 lbs. Winner to be sold for $300.

1. Wm. Cahill's b. g. Rinaldo (6), by Leonatus—Dahlia; 110 lbs.
2. O. Appleby's ch. g. Ringmaster (a), by Buckmaster—Grisette; 114 lbs.
3. Owen Bros.' ch. f. Conejo (4), by Royal Flush—Lady Emma; 113 lbs.
4. J. Coffey's ch. g. Galanthus (4), by Imp. July—Snowdrop; 103 lbs.
5. B. F. Hobart's ch. g. Limber Jim (a), by Snuff-Box—Mildred; 116 lbs.
6. W. B. Jennings & Co.'s ch. g. Canderos (4), by Candlemas—Hinda Dwyer; 113 lbs.
7. P. Donalache's b. c. Wardman (3), by Tammany—Belinda; 104 lbs.

SUMMARY.

Conejo (Foucon)	1
Rinaldo (Hoar)	2
Ringmaster (Burlingame)	3

Time—1:35½.

RACE No. 57—RUNNING.

Sunny Slope Stake; for two-year-old fillies. Five furlongs. Entrance $10, to accompany nomination; $15 additional if not declared by 4 P. M. the day preceding the race; $300 added by the Society, of which $50 to second and $25 to third. Weights 5 lbs. below the scale. A winner of a stake race in 1901, or a winner of three or more races of any value, other than selling races, 5 lbs. extra. Non-winners of two races allowed 4 lbs. Maidens allowed 7 lbs., and if such are the produce of a mare that has not produced a winner at the time of starting, 10 lbs. Maidens beaten three or more times since closing of the stake, allowed 5 lbs.; and if not placed second or third, 7 lbs. additional. Closed with 16 entries. Total value, $520.

1. J. S. Campbell's ch. f. Innocencia (2), by Emperor of Norfolk—Espiritu Santa; 115 lbs.
2. A. J. Stemler's br. f. Divina (2), by Bassetlaw—Angelita; 115 lbs.
3. Burns & Waterhouse's b. f. Doreen (2), by Torso—Decoy Duck; 110 lbs.
4. W. B. Jennings & Co.'s b. f. Sister Jeannie (2), by Imp. Midlothian—Fannie Louise; 115 lbs.

SUMMARY.

Doreen (Ransch)	1
Sister Jeannie (Logue)	2
Divina (Ruiz)	3

Time—1:00⅗.

RACE No. 57A—RUNNING.

Handicap for two-year-olds. Five furlongs. Purse, $225; of which $40 to second and $15 to third.

1. Stanfield & Ellis's b. f. Flo Culver (2), by Lew Weir—Juanita; 90 lbs.
2. W. B. Sink, Jr.'s b. c. Dawson (2), by Maxio—Easter; 90 lbs.
3. E. Lanagan's br. g. Hainault (2), by St. Carlo—Libbertiflibbet; 110 lbs.
4. W. B. Jennings & Co.'s b. c. Lapidus (2), by Imp. Star Ruby—Pearl V; 106 lbs.
5. J. S. Campbell's b. f. Huachuca (2), by Emperor of Norfolk—La Plata; 116 lbs.
6. J. P. Atkins's b. g. Jarretiere d'Or (2), by Golden Garter—Ricardo; 116 lbs.

SUMMARY.

Hainault (Hoar)	1
Lapidus (Ransch)	2
Jarretiere d'Or (Ruiz)	3

Time—1:01.

RACE No. 58—RUNNING.

The Governor's Stake; a handicap for three-year-olds and upward. One mile and a furlong. Entrance $10, to accompany nomination; $20 additional for horses not declared by 4 P. M. day preceding race; with $400 added by the Society, of which $70 to second and $30 to third. A winner of a race other than a selling race, after the weights are published, to carry 5 lbs. extra. Closed with 19 entries. Total value, $680.

1. W. B. Jennings & Co.'s b h. Vesuvian (4), by St. Andrew—Hot Springs; 118 lbs.
2. Burns & Waterhouse's b. g. Scotch Plaid (6), by Imp. Midlothian—Mottle; 111 lbs.
3. G. Miller's br. h. Sir Hampton (4), by Imp. Watercress—Lizzie Hampton; 110 lbs.
4. Owen Bros.' b. f. Flush of Gold (3), by Royal Flush—Gold Cup; 113 lbs.
5. W. B. Jennings & Co.'s b. m. Andrisa (4), by Imp. St. Andrew—Fannie Louise; 108 lbs.

SUMMARY.

Vesuvian (Ruiz)	1
Scotch Plaid (Ransch)	2
Sir Hampton (Logue)	3

Time—1:53½.

RACE No. 59—RUNNING.

High-weight handicap. Six furlongs. Purse, $250; of which $40 to second and $20 to third.

1. C. Young's ch. m. Good Hope (4), by Col. Clark—Gratitude; 114 lbs.
2. W. L. Stanfield's br. m. Kitty Kelly (4), by Apache—Playtoy; 105 lbs.

3. T. J. Field's b. g. Rey Dare (3), by El Rio Rey--Lady Dare; 108 lbs.
4. Wm. Cahill's b. g. Prestidigitator (4), by Russell—Active; 105 lbs.
5. P. Sheridan's b. g. Sir Dugald (3), by Imp. Dandy Denmont—Queen F; 115 lbs.
6. G. W. Snider & Co.'s ch. m. Vantine (4), by Imp. Anchorite—Vestina; 108 lbs.

SUMMARY.

Rey Dare (Ransch)	1
Sir Dugald (Foucon)	2
Good Hope (Ruiz)	3

Time—1:13¼.

Race No. 59a—Running.

For three-year-olds and upward. Seven and one half furlongs. Selling. Purse, $200; of which $35 to second and $15 to third. All to be sold for $100.

1. Miss M. O'Connell's ch. g. Boardman (5), by St. Charles or Willful—Rosewood; 110 lbs.
2. T. Rector's ch. m. Mountain Dew (5), by Blazes—Alice B; 106 lbs.
3. P. Holly's br. g. Bob Palmer (3), by King Regent—Crescendo; 106 lbs.
4. J. D. Dunn's br. g. Pegalong (3), by Imp. Crighton—Sweet Peggy; 106 lbs.
5. Lone Stable's br. g. Casdale (5), by Favordale—Castalia; 112 lbs.
6. J. Webb's br. g. San Augustine (5), by Emperor of Norfolk—Hook Blonde; 115 lbs.
7. Thomas Latta's b. g. Pongo (6), by El Rio Rey—Ogalena; 110 lbs.
8. L. Tryon's b. m. Galene (4), by Imp. Brutus—Picnic; 108 lbs.
9. W. D. Hayes's b. g. Ravino (3), by Racine—Precious; 108 lbs.
10. D. F. Cox's ch. m. Castaine (5), by Eotheon—Pearlfinder; 110 lbs.

SUMMARY.

Galene (Burlingame)	1
Casdale (Ransch)	2
Castaine (McNichols)	3

Time—1:35½.

FRIDAY, SEPTEMBER 13, 1901.

Race No. 60—Trotting.

Special. 2:14 class. Purse, $400. Mile heats, three in five.

1. I. Mulholland's (Independence) b. h. Osito, by McKinney—Twilight.
2. F. Ward's (University) blk. h. McKenna, by McKinney—Etta Wilkes.
3. L. M. Clark's (Sacramento) b. h. Ouiboul, by Stamboul—Ouida.
4. S. A. Hooper's (Yountville) br. h. Alta Vela, by Electioneer—Lorita.
5. E. Lafferty's (San Francisco) br. h. Boydello, by Boydell—by Durango Chief.

SUMMARY.

Osito (I. Mulholland)	1	5	1	1
Alta Vela (S. A. Hooper)	4	1	2	2
Ouiboul (L. M. Clark)	2	2	5	r. o.
Boydello (E. Lafferty)	3	3	3	r. o.
McKenna (F. Ward)	5	4	4	r. o.

Time--2:16¾, 2:17, 2:18, 2:16.

Race No. 61—Pacing.

Special. 2:12 class. Purse, $400. Mile heats, three in five.

1. J. Heines's (San Francisco) br. h. John A., by Wayland W—Lady Moor.
2. Ed. Kavanaugh's (Vallejo) ch. h. Gaff Topsail, by Diablo--Belle.
3. G. Trank's (Chico) b. g. Harry J., by Reavis's Steinway—Jennie June.
4. A. L. Conkling's (Bakersfield) b. m. Edna R, by Sidney—by Director.
5. C. W. Mains's (Corona) b. m. Queen R, by Redondo—by Adrian Wilkes.

SUMMARY.

Edna R (I. Mulholland)	1	1	3	1
Gaff Topsail (I. Smith)	2	2	1	2
Harry J (J. Wheeler)	4	3	2	r. o.
Queen R (Millikens)	3	5	4	r. o.
John A (W. Masten)	5	4	5	r. o

Time—2:16½, 2:18½, 2:17¼, 2:24½.

Race No. 62—Running.

For three-year-olds and upward, maidens and non-winners of a race in 1901. Six furlongs. Selling. Purse, $225; of which $40 to second and $15 to third. Three-year-olds to carry 107 lbs.; four-year-olds and over, 110 lbs.; those beaten at this meeting allowed 5 lbs. Winner to be sold for $200.

1. Murray & Collins's ch. g. Toribio (6), by Apache—Marion; 105 lbs.
2. M. Kane's b. g. Rio Colorado (4), by Rio Bravo—Commotion; 105 lbs.
3. W. D. Hayes's b. g. Ravino (3), by Racine—Precious; 102 lbs.
4. R. E. Dolan's ch. g. Howard (a), by Tyrant—Mayetta; 105 lbs.
5. C. W. Carroll's b. f. Chaste (3), by Jim Gore—Imp. British Blue Bell; 99 lbs.
6. Thomas Latta's b. g. Pongo (6), by El Rio Rey—Ogalena; 105 lbs.
7. J. Webb's br. g. San Augustine (5), by Emperor of Norfolk—The Hook Blind; 105 lbs.
8. M. Duffy's b. m. Phlegon (4), by Imp. Piccolo—Little Rose; 105 lbs.
9. T. Rector's br. g. Billy Moore (4), by Imp. Duncombe—Allanah; 110 lbs.

SUMMARY.

Toribio (Hoar)	1
Phlegon (Ransch)	2
Howard (Burlingame)	3

Time—1:14½.

Race No. 63—Running.

For two-year-olds, non-winners at this meeting. Five and one half furlongs. Selling. Purse, $250; of which $40 to second and $15 to third. 7 lbs. below scale. Those beaten and not placed second or third, allowed 5 lbs. Winner to be sold for $200.

1. J. Weber & Co.'s br. f. Torso Maid (2), by Torso—Happy Maiden; 103 lbs.
2. G. Summers & Co.'s ch. h. Tyrannus (2), by Imp. Star Ruby—Torsina; 111 lbs.
3. J. S. Campbell's b. c. Huachuca (2), by Emperor of Norfolk—La Plata; 106 lbs.
4. G. W. Snider & Co.'s b. f. Mariosa (2), by Imp. Mariner—Shannon Rose; 103 lbs.
5. P. Smith's ch. g. Fred Atterbury (2), by Bowling Green—Kittie Waddle; 106 lbs.
6. A. O. Manning's b. f. Irma A (2), by Rey El Santa Anita—La Vienta; 108 lbs.
7. L. A. Blasingame's b. c. Porous (2), by Wernberg—Chevy Chase; 106 lbs.

SUMMARY.

Huachuca (Hoar)	1
Torso Maid (Ransch)	2
Fred Atterbury (Timmons)	3

Time—1:09.

Race No. 64—Running.

For all ages; non-winners at this meeting. One mile. Purse, $200; of which $35 to second and $15 to third. All to be sold for $100.

1. D. F. Cox's ch. m. Castaine (5), by Eotheon—Pearlfinder; 109 lbs.
2. E. B. Smith's b. g. Sea Spray (a), by Imp. Mariner—Marinette; 107 lbs.
3. T. E. McLaughlin's ch. g. Mike Rice (a), by J. H. Fenton—Mrs. McAllister; 112 lbs.
4. J. Weber's b. m. Lizzella (a), by Morello—Lizzie Dunbar; 109 lbs.
5. J. S. Campbell's b. g. El Mido (5), by Sir Modred—Ethel; 107 lbs.
6. O. Appleby's ch. g. Ringmaster (a), by Buckmaster—Grisette; 112 lbs.

SUMMARY.

Lizzella (Ransch)	1
Mike Rice (Tullet)	2
Ringmaster (Burlingame)	3

Time—1:42½.

Race No. 65—Running.

For three-year-olds and over; non-winners of more than one race since June 15. Six furlongs. Selling. Purse, $225; of which $40 to second and $15 to third. 5 lbs. below scale. Beaten non-winners since September 1 allowed 5 lbs. All to be sold for $200.

1. P. Crowley's b. h. Gusto (4), by Imp. Brutus—Irish Lass; 112 lbs.
2. Walter Maben's b. m. Miss Vera (4), by Amigo S—Fame; 114 lbs.
3. J. D. Dunn's br. g. Pegalong (3), by Imp. Crighton—Sweet Peggy; 106 lbs.

4. C. Young's ch. f. Eonic (3), by Eon—Mermaid; 108 lbs.
5. D. Morgan's b. g. McFarlane (6), by Imp. Mariner—Moonlight; 117 lbs.
6. Burns & Waterhouse's ch. g. Rollick (3), by Take Notice—Happy Maiden; 111 lbs.

SUMMARY.

Eonic (Hoar)	1
Rollick (Ransch)	2
Gusto (Logue)	3

Time—1:13½.

Race No. 65a—Running.

Five furlongs. Selling. Purse, $200; of which $35 to second and $15 to third. Special weights. All to be sold for $100.

1. F. Allen's b. m. Blue Bell (a), by Prince of Norfolk—Gem of the Mountains; 107 lbs.
2. G. L. Richardson's blk. m. Pidalia (4), by Idalium—Piquant; 107 lbs.
3. J. Whalen's b. m. Swiftwater (4), by Imp. Candlemas—Repleta; 107 lbs.
4. H. L. Haskell's ch. g. Gold Baron (5), by Imp. Rayon d'Or—Ballerina; 107 lbs.
5. L. Tryon's b. m. Galene (4), by Imp. Brutus—Picnic; 112 lbs.
6. E. Carey's b. f. Catherine Bravo (3), by Rio Bravo—Catherine B; 110 lbs.
7. Wm. Cahill's br. c. Lief Prince (3), by Prince Lief or Bermuda—Natalie; 100 lbs.
8. P. E. Smith's ch. m. Nettie Clark (4), by Rio Bravo—Apollinaris; 107 lbs.

SUMMARY.

Gold Baron (Howson)	1
Catherine Bravo (Logue)	2
Galene (Tullett)	3

Time—1:01½.

THE IMPORTANCE OF SELECTION IN BREEDING ANIMALS.

BY LEROY ANDERSON,
Instructor in Dairy Husbandry, University of California.

Presented at the Annual Meeting of the Jersey Breeders' Association of Southern California at Riverside, March 15, 1902.

As a text for the subject under consideration, I want to take a few words of Professor W. H. Brewer, of Yale University, who is one of the wisest and most thoughtful students in the country upon the principles of breeding animals. The words constitute one of the laws that he laid down some years since as governing the best practice in breeding, and are as follows: "Vastly more animals are born than are needed for breeding, and only those possessing the highest aggregate of good points should be used to breed from." This principle he termed "Selection." If we analyze the word and study it in its fullest sense, we find it to be very comprehensive; and not only the corner-stone of the breeder's practice, but the entire foundation upon which he is to build the framework and the complete furnishing of a good herd of animals. Selection includes in its scope those primary laws of heredity and variation which Professor Brewer also defines—the former in the sense that all animals resemble their parents and ancestors in most characteristics; and the latter, that no two animals are alike in all characteristics, and hence the offspring are never exactly like their parents. I say that selection includes these, because in practice we retain those animals for breeding purposes which possess in the greatest degree the good qualities of parents and ancestors, or we retain those that show any decided variation for the better over their parents.

The theory and practice of selection also bring into play a careful observation to find out the animals in our herds which show the most adaptability to their environment as to soil and climate; which show the greatest improvement under increased feeding; which show themselves best adapted to their special purpose, whether that be to produce meat or milk; and which are most prepotent in giving their own good qualities to their offspring.

Darwin, in his notable work on Animals and Plants under Domestication, defines three kinds of selection, viz.:

1. Methodical, or that kind of selection which a breeder uses when he has in mind an ideal animal, and mates his animals with the purpose to produce one approaching as nearly as possible to that ideal.
2. Unconscious, or that kind of selection which a breeder uses when he mates the best animals of both sexes without making any study of

their peculiar individual characteristics and without having in his mind any fixed ideal toward which he is working.

3. Natural, or that kind of selection which we find in practice among animals in their wild or native state where the mind of man is not a controlling factor.

As members of the Jersey Breeders' Association of Southern California and men who are breeding thoroughbred cattle, I presume each of you may be counted among those who are practicing methodical selection. That is, each of you carries in your mind a picture of the Jersey cow which is your ideal of what the perfect cow should be, and you mate your animals with the idea of producing living specimens of that mental picture. Such practice is the kind that results in the most rapid improvement and has worked such wonders in the development of all improved breeds of livestock, and has, moreover, given the world the families which are noted for so great powers of production. In this noble and worthy field of progress, I am sure the Jersey Breeders of Southern California are active workers.

The possibility, and the power as well, of selection depend upon the fact that all organic beings are variable. It is a common observation, known to even the most casual observer, that all animals vary in their several characteristics; that the offspring are never exactly like their parents. The heifer when it comes to maturity may be almost the perfect image of its dam, but you who study both carefully can see differences in form. And if the form be very similar, the chances are that there will be differences elsewhere, possibly in the milking qualities. Variability is sure to result in all breeding. Why this is so is not so easily demonstrated as the fact that it is so. The principle which we call heredity is strong and subtle in its workings. We may see to-day the effects of an inheritance of many generations, or even a century ago, and because we behold some features in an animal which we can not see in the living ancestors we are apt to call it an unaccountable variation, while in reality what we see is genuine heredity, only we can not perceive the line of transmission.

There are many causes, any one of which may lead to a variation from the parent stock. Chief among these causes is the influence of food, either scarcity or abundance. In the upbuilding of all our improved breeds of stock no one factor has exerted a stronger influence than food. By an abundance of the best kinds, some members of each generation have been made a little better than the animals in the previous generation. The dairy cow has been made to produce a little more milk and butter than her dam; the beef animal has been induced to lay on his fat a little more evenly and more in the valued parts; the lines of the hog have been made slightly more even; the sheep has put on a little finer wool, or a better quality of mutton; the hen has been made a little rounder and plumper or made capable of laying a few more eggs. All these are variations that improved feeding have made possible, and being accelerated from generation to generation by wise selection there results a final grand improvement.

The care of the animals, aside from food, is another potent factor in variation. Climatic conditions are of great importance in this particular, and should be studied with care by all who wish to improve their livestock. Subjection to unusual cold or to cold storms causes a migration of food material in the animal's body from the work of building tissue or of secretion, to the work of keeping the body warm. This causes a check in the development of meat or milk, as the case may be, and the seriousness of the check, or the certainty of the animal's overcoming its effects, depends upon the length of time during which the change in the use of food nutrients continues. If it be for a brief time only, the result is not likely to be serious. If the period be a long one, the chances are that, in the case of a milch cow, the former flow of milk will not be recovered during the present lactation period. There is then a loss of food, as well as a forced change in animal function. Lumber is always considered cheaper than food to protect animals from undue exposure. Moreover, the variation which is caused in the animal by lack of care is always a detrimental one, and one that we do not wish to propagate.

Another cause of variability is the practice of crossing breeds; that is, mating two thoroughbred animals of different breeds. This practice is one that appeals very strongly to those whom we may call the laymen among breeders. They are not strictly breeders, because they are in the stock business solely for the product of the animals and not for the purpose of building-up a herd of thoroughbred stock. They look over the different breeds, and do not see one that singly combines all the qualities which they desire their herd to possess, whereat they conclude to cross two breeds, the union of which ought, from their point of view, to result in just the real thing. There is both advantage and disadvantage in this practice. The main advantage is that crossing usually results in a stronger constitution. The disadvantage is that it likewise causes an undue amount of variation. Two breeds that have been reared along special lines for many generations, and whose characteristics have become fixed in different directions, are mated. There is a clash of characters, as it were, and the resultant offspring may possess the parents' virtues in equal degree, but it is more likely to possess the characteristics of the stronger parent to the largest extent, or to revert to several generations back for its inherited qualities where the characteristics were poorer than is now possessed by the immediate parents.

A familiar example of crossing is mating the Jersey and Holstein, the owner reasoning thereby to secure the large milk flow of the latter and the high quality of the former. Why is he not as likely to secure the small yield of the Jersey and the low quality of the Holstein? At the best he is fortunate if he secures an animal which is a fair average between the two breeds. The instances where this kind of crossing has been practiced are not measured by a large proportion of successes. Experience has shown that breeding to the thoroughbred idea is the right road to success. Crossing may cause a good variation, but once caused there is little opportunity to take advantage of it, because it can not easily be perpetuated. If we breed the animal possessing the desired variation to another cross-bred we are quite as likely to cause retrogression as to make improvement. This practice is one of the means of forming new breeds; but building new breeds is an art requiring the highest degree of skill and intelligence. And why try to form new breeds when there are enough old ones to fit any possible condition or set of conditions? If we breed to a thoroughbred of either of the two breeds we are returning to the thoroughbred idea, where we might better have remained at the beginning and seek our improvement through a less radical variation.

I take it that the breeders of thoroughbred stock are seeking to-day to cause variability in order that there may be some opportunity for the practice of selection. Were there no variability all animals would be alike, and there would be no selection; neither would there be any improvement. Even though the breeds of farm animals have reached a high stage of improvement, no one believes that the opportunities for improvement are passed. There is a higher authentic record for butter production to be made than is now on the books, and what is still more important and far-reaching in its effects, the average production of even registered cows is capable of being increased to a very large degree. The kind of variation that breeders are attempting to cause is not of the radical sort, not of the kind that marks a decided difference between individuals. Variations of this sort are difficult to perpetuate, even though they may be in the right direction. The variation that is attempted is the gradual change, a slight improvement from generation to generation, caused by improved food conditions, better care, and judicious mating of animals which show tendencies to vary in the right directions. The gradual change is easier to perpetuate than the marked variation which makes an animal stand out from the members of its own breed almost as much as it would from the individuals of another breed.

The ability to detect the gradual changes in animals is a prime requisite of the skillful breeder; for the importance of selection lies in the power of the breeder to select these scarcely appreciable differences in the animals which he is handling. Such differences are capable of transmission, and if they can be accumulated after a few generations the result may then be seen by every one. You who are with your cattle every day can point out defects in certain particulars or good indications in other directions which I could not see before your suggestions were made. It requires constant study and a faculty for close discrimination, which unfortunately few persons possess, to be able to see the minute variations that should be seen in order to give to selection its greatest value in breeding animals. Having discovered the differences, however small, if the breeder take advantage of them he can work wonders in the development and improvement of his herd. As a breed grows older and the various families or strains have been bred along similar lines, the individuals become more and more uniform in characteristics, and the difficulties attending wise selection increase. Improvement, therefore, becomes more gradual, and the breeder who desires to do his share in the upbuilding of his favorite breed must be alert and be acquainted with his individual animals.

The effects of selection are seen in the general development of the whole animal, but more particularly are they shown by a development of such parts of the animal as are most highly prized as a source of beauty, food, or revenue. The hair of the Angora goat is made finer during succeeding generations, because that is the part of the animal which is most valued. The wool of the Merino and the mutton of the Shropshire have been greatly improved in quantity and quality, because these were considered of highest value. The loin and thigh of the beef animal have been increased in size, because the breeders have sought meat rather than milk production and they have striven to put the flesh upon such portions of the animal as will bring the largest financial return. The dairy cows have been induced to give ever increasing amounts of milk, oftentimes to the injury of good form. And all these things have been done by man selecting the animals for breeding purposes which showed the strongest tendency to form the product which he considered most valuable. He led his cattle to produce milk or meat according as his conditions determined whether he could receive larger returns from dairy or beef products.

It is not to be supposed that the Shorthorn was developed as a beef animal and the Holstein-Friesian as a dairy animal because there was no other alternative in either case. Possibly natural food conditions were such as to foster the development of the two breeds as we find them to-day. Nevertheless, if the men who are responsible for the breeds had selected for breeding the Shorthorns that showed the greatest tendencies toward milk production and the Holstein-Friesians that showed the strongest tendencies toward flesh production, the tables would have been reversed, and we would to-day be classing the Shorthorn among the special dairy breeds and the Holstein-Friesian among the beef breeds. The facts are that the English people were demanding a better quality of meats, and the originators of the Shorthorn set about to supply the demand by breeding their cattle accordingly. In Holland, market conditions were such as to make butter and cheese more profitable than beef alone, and so the Dutch farmer selected his best milking cows to breed from. Along similar lines selection has shown its results in all kinds of animals.

The breeder may know ever so thoroughly the possibility, the importance, and the effects of selection, but in the practice of selection—"there's the rub." It is one thing to know what ought to be seen and done. It is quite a different thing to see and to do. The breeder may be skillful in discrimination of slight variations, but some day he is obliged, in order to prevent inbreeding, to depend upon a brother breeder to select a sire to head his herd. This sire may not prove to be a good selection, but the circumstances are such that he must be used, with the result that many of the valued points toward which the breeder had been working for years are lost in a generation. The moral would seem to be that each breeder should make personal selection of all his stock. This, however, is impossible in most instances. Another man's ideas of excellence and judgment must be depended upon, when, if anything goes wrong, there remains the satisfaction of laying the blame on the other fellow.

It may be some consolation to believe that a larger stress needs to be laid upon selection, so far as the eye is concerned, in meat-producing then in dairy stock. Outward form may be some indication of milk qualities, but the real and accurate judgment must always be based upon the yield of milk and butter. Dairy qualities and power for production should have first place over any fancy points of color or form. Happy is the man who can combine in his animals both beauty of form and profitableness of production. But form, other than that which is necessary to indicate strength of constitution and capacity for production, should usually be sacrificed, if necessary for production itself.

The chief criterion for judgment in selecting his animals being actual production, the breeder of dairy stock has his work simplified by the use of modern and convenient methods for finding what his cows are doing. The Babcock test is much easier than the churn and equally accurate in determining a cow's production of butter-fat. We need not consider butter. It is not produced by the cow, but is made by man. And I hold that a breeder of thoroughbred dairy stock who does not systematically test his cows so as to know at least the approximate yield of each one is not living up to his opportunities and is not worthy of patronage by those who are seeking animals for breeding purposes. In the first place, he does not know which are his best cows, nor which are showing the greatest variation or improvement over their dams. Second, if he knew what each cow were doing he could sell some of his stock for twice the money he now receives, because of the authentic records behind them. Moreover, he might send some of the bulls, which he is now selling for breeding purposes, to the butcher, and thereby improve the breed.

This thought calls to mind again our text, viz.: that vastly more animals are born than are needed for breeding purposes. It is unfortunate for the sake of a more rapid improvement of all breeds that this is not as true in practice as it is in theory. The fact is, that there is a demand for very nearly all the thoroughbred dairy stock that is born, and that for breeding purposes. Breeders, then, can not be blamed for selling a bull calf for as much money as the same animal would bring for beef at the age of two or three years. But so long as this continues we can not look for as rapid improvement, even among thoroughbred stock, as we could if a more rigid selection were followed, even to the killing for veal of one half of all calves that are born. Because a calf is eligible to have its name recorded in a herd book is no sign in itself that it is worthy of an opportunity to perpetuate its kind. Such opportunity should be given only upon the basis of actual production by its immediate ancestors. And one reason, at least, why so much fault is found with thoroughbred stock on certain occasions is because a careful selection is not made, and because of the opinion too often prevailing that an animal must be good because it is a thoroughbred. The time will probably never come when there are not some poor individuals in any or all breeds, but they will grow less only in proportion as there is a rigid use of the knife upon all inferior animals.

If the cattle club or registry association does not provide a roll of honor wherein may be entered the names of all animals which have proven themselves capable of high production, then let the breeder establish a roll of honor for his own herd, and let him follow closely its figures when mating his animals. Let him combine the teachings of its pages with what his eye tells him of individual merit as to form and quality, and his matings will be of such a high order as to give him ample reward for all his trouble. In selecting breeding animals, then, there must be considered individuality, the breeder's idea of the standard of excellence, and above all the pedigree that is supported by a high, uniform production.

I would consider myself as losing an opportunity did I not add a word of encouragement, though you may not need it, to you who are working for the upbuilding of one of the greatest wealth-producing breeds of cattle that the world has known. That you are daily in contact with nature and nature's forces is in itself a cause for congratulation. But there is still greater cause when we consider that you are using these forces to mould new types and to improve upon old ones.

The forces with which you are working are plastic and mobile, ready to respond to the slightest touch or change in environment which your mind may dictate and which your study may tell you is wise. The world needs more Burbanks—men who study nature carefully and live with her to find out her ways of working. Although the Burbank whom California is proud to call her own, works in the field of plants, there is opportunity for the same spirit and the same attention in the animal field. Results may come more slowly, but if followed diligently they are bound to fruit. Moreover, the fact of having an ideal and striving to attain it, is a virtue in itself and makes a man among men. There is reason for thanksgiving that we have the field of nature in which to work, and I congratulate you that you are so well advanced therein.

THE NECESSITY OF USING PURE-BRED SIRES IN FLOCKS AND HERDS.

By S. B. WRIGHT, of Santa Rosa.

"None but the rich can afford to raise scrubs."

If there were in this country any way of arriving at conclusions, approximately correct, as to the breeding of given animals without the aid of record associations, a stickler for pedigree in connection with form or performance might stand upon uncertain ground.

But as "the best are none too good" where such energy, money, and time are involved as the breeding of stock demands, the importance of being able to trace correctly, for many generations, the breeding of all animals intended for use in "grading up" on common stock or for sires or dams as foundation stock in pure-bred flocks or herds would seem beyond question.

That "like begets like" is accepted as true in this connection; but with only part of the blood pure or of the desired strain, "like" has two factors, and the undesirable one is apt to "crop out" in the progeny with provoking frequency. A breeder is always puzzled to know how to eliminate in the offspring the objectionable points of their ancestors, and to perpetuate the desirable characteristics. There is only one certain and economical way of "grading up" on common stock, and that is by using nothing but pure-bred sires. This may seem expensive when compared with the practice of buying cheap bulls or boars or rams, or hiring the service of cheap stallions; but when one becomes educated to the better prices and realizes how shamefully extravagant and wasteful of funds and time it will prove to breed from poor sires, worthy animals will command good prices.

A few years ago, when really first-class bulls were cheaper than at present, one of my neighbors went East, expecting to bring home about the best serviceable bull to be found of a certain breed. His ideas, as he told me, were about $300. To his surprise he soon found that yearlings commanded that much. It seemed unreasonable to pay that price, add the freight, and then ship the bull to California. He would be laughed at. But everybody asked prices about the same, and sold stock, too. This neighbor began to think, and finally concluded that perhaps he did not appreciate a good thing anyway, and then paid the price asked for a very fine animal, securing one of the best individuals of that breed that has ever come to California, and an animal that has made him more money than any other.

There are conditions prevailing, however, where it is impossible to get anything but grades or "cross-bred" sires. At best, results from this plan of breeding are disappointing. Of course, this is better than no effort at improvement; but there is no good reason, theoretically or practically, for assuming that undesirable characteristics of dams or sires so bred will not be transmitted to their descendants with quite as much certainty as their desirable features. Under such a system of breeding it is not possible to determine from year to year whether any improvement is being made.

Until recently it was deemed impracticable or impossible to make prime beef out of range-bred cattle before the animals were three to four years old. Now, range-bred cattle only one year old are fed in Eastern lots and often top the markets on price before they are two years old, and weigh from 1350 to 1600 pounds gross. But such cattle are well bred, even though grown on the ranges. The "Breeders Gazette" (Chicago) of January 29, 1902, contains an article so applicable in this direction that I can not refrain from presenting part of it. It says: "We may therefore be pardoned the presentation of the accompanying brief statement from Mr. Richard Walsh, general manager of the Adair Ranch, on which the *champion carload of steers at the recent international* [show] was bred: 'In carrying off the championship, the Texas steers have done what you warned the States' farmers would happen—namely, that they would not pay the price for good bulls, and that some day they would awaken to the fact that the best bulls were on the ranges and that steers would come off of these ranges quite fit to compete with the best of the natives.'" This is an age of baby meat, and by the use of bulls in herds that were bred under the eyes of men whose lives were devoted to the production of cattle yielding the greatest gain on food consumed, range-feeders are being produced to meet the requirements of the feed lot as well as of the butcher. Without the use of pure-bred sires it would have been impossible to effect such results within a reasonable period.

By way of showing the perfection attained by pure-bred animals, the Hereford steer, Alamo Champion, bred by Mr. John Sparks, of Reno, Nevada, is one to the point, although rather an extra specimen. He weighed 1900 pounds, was sold for $10\frac{1}{2}$ cents per pound (gross), and dressed $70\frac{1}{10}$ per cent, the heaviest dressing of any steer ever killed at the Armour Packing Company's yards, Kansas City. After giving due credit to the conditioner of this steer, the fact remains that he was a triumph of the breeder's art and a monument to the credit of pure-bred stock. If *one* steer can be made to lose only $29\frac{9}{10}$ per cent in dressing, *many* may be made to do as well by patient breeding and proper handling. It should be gratifying to all that Holstein cows have shown tests of more than 20 pounds per week of butter-fat in recent trials, and that some of these cows yield from 420 to 525 pounds of butter per annum, and with their milk testing a low percentage of butter-fat. The mere presence of a large percentage of butter-fat in milk is not evidence that the cow yielding it is profitable. There are other cattle that might be given tests with surprising results, and a thorough educating of our people along this line would doubtless result in a vast increase of the visible supply of beef cattle on this coast. Some of the best families as beef cattle among the Shorthorns have individuals of rare merit as milk and butter producers.

Possibly it is not generally known that the Scotch-bred Shorthorn cow, Missie 163d, for which Messrs. W. C. Edwards & Co., of Canada, paid

$6,000 at Chicago recently, belongs to a family in which there are many noted milkers.

In sheep, the feeding of lambs has become a great industry. Although market conditions proved a bit unsatisfactory for this business in 1901, the fact remains that meat can be put on lambs at less expense than upon grown sheep, and that in order to raise good feeding lambs, their sires or dams must be of some good mutton type. As long as sheep are held in large flocks and herded on the ranges, Merino ewes will be retained; and where feeders are to be produced, rams from some of the mutton breeds will be used. Think of lambs weighing 90 pounds at ninety days old! Eastern breeders of mutton sheep claim to produce them, and possibly do accomplish that result; but 65 to 70 pounds in ninety days can surely be made with good lambs. Our small farmers patronize the breeders of pure-bred mutton sheep too little and the butcher shops too much. My own preference is for the mutton sheep that will drop lambs at any season of the year desired—not many will do this; but there are such breeds. Every good farm of 100 acres could carry forty or fifty well-bred mutton sheep. Many of these could be *pure-bred* and registered. A large percentage of the meat used at home should be from the home flock, and by the sale of choice individuals for breeders, money could be provided with which to buy other meat. Mutton types do not bunch and travel like the Merinos do. They will stand in one place and feed until *full*, and then lie down like a well-bred beef steer.

Five-hundred-pound hogs at one year old. "How do you make them ?" asked a friend. It is useless to feed for this result, unless it be the right hog. However, the best ones do make that weight at twelve months old, and occasionally one does better. But the most agreeable feature about handling such hogs is their readiness for market at a young age, and the juicy, white, tender meat of these animals weighing 200 pounds at seven months old. Contrary to the ideas generally accepted, the most rapid growth in young hogs is attained, and the best meat produced, while the youngsters are allowed plenty of exercise and an abundance of green feed, or its equivalent, in connection with a grain ration. An exception to this plan of exercise is conceivable when the chief ration for pigs is sour milk. However, sweet milk, with a small percentage of ground grain added, is far superior to sour milk as a ration for young hogs.

Some good results are reported from tests in feeding pure-bred hogs. W. E. Spicer reports as follows on the registered sow No. 7: She had been exhibited at the fall fairs in 1888, and was therefore in good condition. She was weighed at 4 o'clock P. M., having eaten at noon all the shelled corn she wanted. After that, during the period of test, seven days, she was fed three times daily on corn meal soaked from one feed to the next, generally using dish water. She had during the week two or three feeds of pumpkins. At the end of the period she was weighed, and found to have gained 46 pounds in the seven days. Although the meal was not weighed at the beginning of the test, the barrel out of which she had been fed was again filled with meal, and, as the feeder believed, just about as it had been when the test commenced, and that meal was found to weigh 90 pounds. In other words, this sow had increased her weight from 632 pounds to 678 pounds, a gain of 46 pounds in seven days, having consumed about 90 pounds of corn meal soaked in dish water, with the addition of a few feeds of pumpkins. In the fall of 1890 Mr. Spicer fed the registered sow Romford 2d (15790), with a view of learning how many pounds of corn meal would make a pound of pork. In a seven-day test this sow increased her weight from 491 pounds to 525 pounds, thus gaining 34 pounds and consuming 97 pounds of corn meal, no other feed being given. Another sow increased her weight in thirty days from 485 pounds to 611 pounds, a gain of 126 pounds, or 4⅕ pounds per day, consuming 515 pounds of a mixed grain ration and 20 pounds of milk, that is, 2 pounds of milk per day during the last ten days of the test.

Mr. Reuben Gentry, manager swine department for Biltmore Farms, North Carolina, states that the registered boar Columbia's Duke (33855) gained over 4 pounds daily for a period of forty days.

It is not at all unusual, where young hogs can get sweet milk, to find representatives of the best breeds weighing 250 pounds at seven months old. In order to carry such weight at this age the animals must have strong bones, stand on straight legs, and have great muscular power. With me, where but little milk can be had for hogs, 90 pounds at ninety days old is considered an excellent weight for pigs. Beyond that age pigs gain faster.

On August 6, 1901, a registered boar 198 days old (6 months 18 days) weighed in medium condition 247 pounds, and the same pig weighed 190 pounds when 159 days old (5 months 9 days). Star Baron, one of my prize yearling boars in 1901, weighed 250 pounds when 221 days old, 300 pounds when 247 days old, and 350 pounds when 276 days old (9 months 6 days). This same boar weighed just about 600 pounds when 13½ months old. Three other young boars when 9 months and 9 days old weighed 332, 335, and 340 pounds respectively. And one of the latter reached the very unusual weight of 750 pounds at the age of 16½ months. None of these hogs were ever confined in close pens, nor did they always have access to sufficient green feed or its equivalent. However, they did have something of the kind during the greater part of the time. In fact, a young hog can not make proper growth if deprived of green feed or its equivalent for any considerable length of time. Any of the large breeds of swine can doubtless furnish individuals capable of making as rapid growth as did those mentioned. However, the hogs responding most rapidly in gain to feed consumed will be those whose ancestors were selected and bred with a view to rapid and economical growth; and it is impossible to follow intelligently through a long line of ancestors, unless indisputable evidence be on record as to the breeding of the individuals.

Even at the risk of being criticized for unpardonable digression, I feel that our State Agricultural College should be mentioned and an appeal be made to our farmers and stock-raisers to unite in a demand for large appropriations for its use. The department of animal husbandry of this institution is getting little attention in proportion to its needs, and yet our farmers and breeders of livestock, the men who pay the bulk of our taxes and contribute most extensively to our wealth, will derive the greatest benefit through the agricultural department of our University, and especially through that branch of it which deals with animal husbandry. Not less than $250,000 should be appropriated at once and be made immediately available for this department of our agricultural college. The farmers and stock-raisers should demand this appropriation from our next Legislature. This is a great State. She has vast resources, but does not produce her own meat. She is capable of doing so, and our people have a right to some education on such points. There is a dairy school in connection with the college; but, so far, "*no cows.*" I am interested in lands upon which several hundred dairy cows are annually grazed; but whenever our tenants undertake to run dairies and pay rent without keeping or owning any cows I shall insist upon knowing all about the *new secret* of paying rent. The dairy department of our State Agricultural College should not only have cows of different breeds and of the best individuals, but there should be land upon which to keep them. The best representatives of the beef breeds should be kept, and so with every kind of animal that is likely to contribute largely toward the wealth of the husbandman. The College of Agriculture should be fully equipped and well maintained, and the department of animal husbandry is entitled to large appropriations of money. If the interests of farmers and breeders of stock are to be neglected on educational lines in order that other branches of our University shall thrive, it is time for the taxpayers to demand just recognition.

THE GROWING OF SWINE.

By C. H. SESSIONS, of Los Angeles.

There is no animal raised on the farm that will grow into money as quickly and with more profit than the hog, and it is a branch of farming that is very much neglected.

In growing swine it is necessary to raise only those strains that will return the greatest amount of flesh, in the shortest time, with a given amount of feed.

In former years, and in fact at the present day, there can be found on many ranches in California, numbers of the native Spanish hogs, or "razorbacks." They are a very hardy hog, but are not proof against the diseases of the more fashionably-bred swine of to-day. They can take care of themselves and live in the swamps and river-bottoms, but it requires two or three years for them to mature, ready to put on fat. Many farmers have dropped this breed and taken up the improved breeds of Berkshire and Poland-China; but there are too many of them left, and it appears that very little attention is paid to getting rid of them. When growing, they will take double the food given a well-bred hog, and require two or three times as long to get ready for market, and therefore it costs about four times as much to raise them.

Through careful selections and judicious breeding, the Berkshires and Poland-Chinas are able to make rapid growth and attain a marketable size in from eight to twelve months. Many of the pigs weigh two hundred pounds at six months of age, but it requires good handling to get such results.

The difference between the two breeds named is not so great as in former years, but they both make good use of their food and put on flesh rapidly. The Berkshires carry a larger percentage of lean meat than the Poland-Chinas, and as the market generally demands this meat, it makes them a very desirable hog. Since cotton-seed oil is being used in place of lard, there is not so much demand for the lard hog.

Many large growers of swine prefer to cross these two breeds, thinking they have a hardier and better feeding hog than in the full bloods.

It used to be claimed that for large ranges the Berkshires were not a success, as they would soon become wild and hard to manage, while the Poland-Chinas were more quiet; but I believe the present strains of Berkshires have been bred on more quiet lines and are not so liable to grow wild and cross.

In taking up the raising of hogs, the first thing, and the most important, is to get good foundation stock. If it requires too much money to buy all thoroughbreds, be sure to get a thoroughbred male with a pedigree, and have him recorded and know he is from good strains.

For sows, take the best you can afford to buy, and cross with the thoroughbred male. I have bred the worst specimens of "razorback" sows I could find, with a thoroughbred Berkshire boar, and have been surprised to see the improvement of the first litters; then cross these young sows with another Berkshire boar, and this second cross produced pigs having all the characteristics of the thoroughbreds. The first cross showed a great shortening of the snout, and the second was as short as necessary. It may be timely to say here, that it is generally believed that short-nosed hogs make better feeders than the old style long-noses, and in selecting sows this should be kept in mind.

A grade male will make no improvement in a herd, and should never be used, as he is liable to breed back to some inferior strain.

Good animals can be had at $25 and upward, and in a short time they will pay for themselves in the improved size and quality of the pigs, which make them profitable feeders.

In selecting breeding animals it pays to visit the State Fair, where there are on exhibition the finest in the State. The visitor is there permitted to see the best of several herds, and he can then compare the different specimens and select the type which he has in mind. If not convenient to visit the State Fair, visit as many herds as possible, and see how they look at home, and selections can be made which would be more satisfactory than to order by letter, leaving the selection with the breeder.

The greater part of the thoroughbred business is done through correspondence, and generally satisfaction is given, as no breeder expecting to remain in the business can afford to take any advantage of the buyer.

I would not recommend breeding animals under eight months of age, nor would I advise waiting until over a year old, as I have had poor success in getting sows with pig after that time. I have bred most of my stock at about eight months, and they have generally made good breeders and good, large-sized animals. If bred too young, they are liable to be stunted and will always be small.

Great care should be used in handling breeding stock. Do not allow them to get too fat, or the litters will be small and weakly. If possible give them a good range, and they will hunt out the grass, roots and all.

Some object to allowing the hogs a pond-hole for a wallow, on account of danger of disease, but I do not think such fears are well founded. They certainly enjoy a bath in the thick mud, and it makes them far more comfortable in a hot day; and in rolling, the hogs get covered with the mud, which kills lice (if they have them). These water-holes can be disinfected with crude carbolic acid or preparations made for the purpose.

If the hogs are kept confined, the pens should be disinfected often and kept clean. A coat of whitewash twice a year is good.

In case of sickness in the herd, remove the healthy ones to fresh pens, leaving the sick ones in the infected pens, and then begin a course of scraping and cleaning out, washing everything with disinfectants.

Give as much green food as possible, and in case of sickness they will be more likely to recover than if fed on an entire grain ration. There is no food better than skimmed milk and a little corn meal or ground wheat. The latter makes an excellent food for young pigs, and if it can be had at a fair price I think it is better than barley for the older ones. Pasture is always good if it can be had, but, if not, fresh-cut alfalfa should be given daily.

POULTRY CULTURE AND ITS ADVANTAGES IN CALIFORNIA.

By HENRY BERRAR, of San José.

Of all the industrial arts, poultry culture offers the greatest inducements and the best opportunities for investment; yet it is a fact that this industry is constantly overlooked by the average individual. The officers and members of the State Agricultural Society recognize the importance of this industry and are using their best endeavors to educate the people and instruct them in this branch of economics. Many of the Eastern States which lack the natural facilities and advantages of California have long since recognized its many important phases, and lend encouragement and support by liberal appropriations for its promotion and by the assistance of those who are willing and anxious to avail themselves of the advantage of experiments conducted scientifically. Systematic reports of progress made, and statistics, are printed; bulletins and pamphlets are distributed to their poultrymen free of charge. The result is that what was formerly the most unimportant adjunct of the farm is now the best-paying element of agricultural investment. In addition to the home product, we are the recipients of hundreds of carloads of poultry products, and there is never a time when eggs and fowls do not command a good market, thus demonstrating that an independent living would be assured to thousands of families who should enter this business to supply our local markets.

There is no fear of this industry being overdone, as there is an unlimited home market for poultry products, and there always will be an unlimited demand for these products in our island possessions and in the Orient.

The United States imported millions of eggs in addition to the estimated $140,000,000 worth marketed last year. The demand increases faster than the supply, and this industry represents to-day, in annual output and stock on hand, the enormous sum of $700,000,000, and is second on the list of industrial economics.

The figures of the Department of Agriculture show approximately, last year, two hundred and eighty-five million (285,000,000) chickens in the United States, and ten billion and one million (10,001,000,000) eggs, or about 655,000 tons, exclusive of all eggs used or consumed before reaching market.

The output of eggs last year was greater than the postal revenues, and large enough to have paid the entire expenses of the War Department.

To encourage the investment of private capital, this State should assist its poultrymen and the public in general in mastering every detail of this business. The lack of interest of the average citizen is only exceeded by the inertia of the State. Breeders and keepers of fowls are uninformed as to the fundamental facts and established principles, which are no longer subjects of experimentation. No State in the Union has greater natural resources, finer climatic conditions, or a better market. Instead of importing poultry products, we should have thousands of poultry farms throughout the State and be exporters. There is no other industry in California which offers a more independent and a more enjoyable way of earning a livelihood; no other department of farming will yield larger returns.

While a flock of fowls is a most valuable adjunct to the farm and orchard, it does not necessarily follow that a successful poultryman must be a farmer. Indeed, many of our most successful poultrymen are "city men," who know nothing about farm work—men who, by close application, study, and work, have mastered the science and art of incubation, brooding, and egg production, and by studying the experiences of others in good "poultry journals" have attained great success in producing first-class stock in every way.

COMBINED FRUIT AND POULTRY CULTURE.

Our orchardists are gradually awakening to the importance of combined fruit and poultry culture. In addition to the valuable service rendered in ridding the orchard of insects, the fowls are a never-failing source of revenue. Poultry distributed throughout an orchard on the colony plan thrive well and yield a large income in proportion to the expense.

At times when the sales of fruit are slow and the returns are disappointing, the busy hen offers relief and assistance by furnishing a product which always commands "ready cash."

A visit to Santa Clara Valley will disclose many orchards in which fowls are kept to destroy the bugs and worms so detrimental to successful fruit culture.

As an instance of the benefits derived from combining these two industries, I respectfully call attention to the fact that in orchards thus protected the canker worm has been kept in check, while in neighboring orchards, devoid of fowls, great expenditures of time and money have failed to accomplish as good results.

With all the advantages to be derived from keeping poultry in the orchard, but few objections can be urged against the proposition, some of which are without foundation in fact. With the exception of prune orchards, during the ripening of the fruit the fowls have not been found to be of any disadvantage. In the peach and apricot orchards they do not damage the fruit when ripening; but in the prune orchard it may be found necessary to confine the fowls during the dropping of the prunes.

In selecting fowls for the orchard probably no other class will prove more serviceable and cause less damage than the Asiatics, as the varieties included in this class do not fly high, hence they can not get into the trees and cause damage while the fruit is ripening.

All of the orchards of this State are capable of supporting a fine flock of fowls, and no orchard will be without them when our orchardists become fully aware of the advantages and profits resulting from the combination of these industries.

NATURAL ADVANTAGES.

California offers ideal conditions for poultry-raising. It is a known fact that all fowls, both old and young, thrive on green foods. No State of the Union produces a greater variety of grasses and vegetables, and the fact that they grow and are cultivated the year round, cheaply and in great abundance, gives the California poultryman a decided advantage over Eastern breeders. Not only is this true of green foods, but the many varieties of grain of the best quality, and mill products, are grown, manufactured, and sold at less cost than in many other States. This fact, taken in connection with our excellent markets and steady demand, explains, in a measure, the success of our poultrymen, and to many should be an incentive to enter into this business, particularly those possessed of limited means and small tracts of land. If these facts were properly placed before the people of this State and of the United States, the importation of poultry and poultry supplies would cease. Many Eastern poultrymen who are put to endless trouble and great expense in preparing for the changes in seasons would investigate and surely avail themselves of these advantages in climate, soil, markets, and productions. Owing to the mild climate in this State, it is not necessary to build elaborate, air-tight buildings, such as are in use in the Eastern States. Any ordinary frame building, with watertight roofing, answers. It is an acknowledged fact that fowls raised in colder climates do not lay as many eggs as do our California fowls.

INCUBATORS AND BROODERS.

In addition to the natural advantages, the incubators and brooders manufactured in this State are considered the equal of any manufactured elsewhere. Thousands of these machines, built on the best principles known in artificial raising of poultry, are shipped to all parts of the United States, and the large shipments to foreign countries are proof positive of the excellence and merit of these machines, which have given our manufacturers a world-wide reputation. Hundreds of mechanics and others who are not directly engaged in poultry culture are thus given steady and lucrative employment.

The introduction of the incubator and brooder has revolutionized this industry. The business has assumed enormous proportions, and each year shows a greater development. Hatching can be conducted continuously throughout the year, and it is easier to raise hundreds of chicks than dozens by the natural method. This practically gives the poultryman control of the conditions necessary to success, enabling him to raise thousands of chicks at the most profitable time of the year. The most money from poultry has been made by those who have familiarized themselves with the details of artificial hatching of chicks.

POULTRY SHOWS.

There is no other feature of the industry which creates so much interest to the public. The constantly increasing interest in exhibitions proves that they are a benefit to the people and the State. In character, in advantage to exhibitors, and in all other particulars our shows equal in all respects the exhibitions held in other States. The numerous attractions and character of the displays always insure a large attendance, but it is a lamentable fact that our shows are few and far between.

Many sections of this State have never enjoyed the advantages of these objective and practical lessons. The State should not depend entirely on the liberality of individuals and associations to educate the people in this industry. A number of distinctly educational shows held throughout the State during the winter months would illustrate the progress made, and to the amateur would be a startling revelation of the magnitude of this business and a lesson in poultry art which would demonstrate and prove the value and advantages of the thoroughbred over common scrub fowls. A well-conducted show is a school-room for the visitor as well as for the breeder. Reliable and truthful information is furnished those seeking knowledge, and as an object lesson to the beginner it is of incalculable value, particularly as the impressions made and the knowledge gained are lasting.

THOROUGHBRED FOWLS.

Of the one hundred and eighteen varieties recognized by the "standard of perfection," possibly one tenth are bred for ornamental and the balance for practical purposes. In this article it is impossible to enumerate or fully describe the value and general characteristics of each separate variety. It will therefore be confined to the fourteen classes into which they are divided, namely:

1st CLASS—AMERICANS.

Breed.	Variety.
Plymouth Rock	Barred. Buff. White.
Wyandotte	Silver. Golden. White. Buff. Black. Partridge.
Java—	Black.
American Dominique.	

The varieties included in this class are considered to be "general purpose" fowls. They are of medium size and average weight, that of matured specimens being about 9 pounds for males and 7 pounds for females. They are good layers, market well, and readily adapt themselves to any condition or climate.

2d CLASS—ASIATICS.

Breed.	Variety.
Brahmas	Light. Dark.
Cochins	Buff. Partridge. White. Black.
Langshan	Black. White.

In this class is included the largest of the standard-bred fowls. Average weight of male, 10 pounds; of female, 8 pounds. It is not uncommon to see many specimens weighing 12 pounds and over. Of the many varieties they are among the most admired, on account of their quiet disposition. Aside from being a good table fowl, they are splendid layers, stand confinement well, and are especially adapted for the "city lot." They thrive exceptionally well in the Pacific Coast States, and as an all around practical fowl they are unexcelled.

3D CLASS—MEDITERRANEANS.

Breed.	Variety.
Leghorn	S. C. Brown.
	R. C. Brown.
	S. C. White.
	R. C. White.
	Black.
	Buff.
	Silver Duckwing.
Ancona.	
Minorca	Black.
	White.
Andalusian.	
Spanish.	

The general characteristics of these varieties are about the same. They are without doubt the best layers, and are very popular with all breeders of standard-bred poultry.

4TH CLASS—POLISH.

White Crested Black.
Golden.
Silver.
Bearded Golden.
Bearded Silver.
Bearded White.
Buff Laced.

In this class are included the most beautiful fowls recognized by the "standard of perfection." They are not only beautiful, but are excellent layers.

5TH CLASS—HAMBURG.

Breed.	Variety.
Hamburg	Golden Spangled.
	Silver Spangled.
	Golden Penciled.
	Silver Penciled.
	White.
	Black.
Redcaps.	

While the Hamburg fowls are considerably smaller than those in any variety of the Mediterranean class, still they are considered by many poultrymen the equal of any fowl as layers, and in beauty rank next to the Polish.

6TH CLASS—FRENCH.

Houdan.
Crevecœur.
La Fleche.

Of this class the Houdan is the most popular variety. They are fine layers.

The Crevecœur and La Fleche varieties are very good "general purpose" fowls, but are not extensively bred in America.

7TH CLASS—DORKINGS.

White.
Silver Gray.
Colored.

The varieties included in this class are not considered good layers, but as table fowls they can not be excelled.

8TH CLASS—GAMES AND GAME BANTAMS.

Breed.	Variety.
Games	Black Breasted Red.
	Brown Red.
	Golden Duckwing.
	Silver Duckwing.
	Red Pyle.
	White.
	Black.
	Birchen.
Game Bantams	Black Breasted Red.
	Brown Red.
	Golden Duckwing.
	Silver Duckwing.
	Red Pyle.
	White.
	Black.
	Birchen.

9TH CLASS—ORIENTAL GAMES AND BANTAMS.

Indian Game	Cornish.
	White.
Malay—	Black Breasted.
Sumatra—	Black.
Malay Bantam—	Black Breasted Red.

The varieties included in these two classes are bred for pleasure as well as for profit. The general characteristics and style are about the same, the difference being in color only.

Contrary to the general opinion and belief, the game fowls above mentioned and recognized by the "standard of perfection" are not bred for fighting purposes, but for general utility and pleasure, and, like the Dorkings, are excellent for table purposes and are fine layers.

10TH CLASS—BANTAMS OTHER THAN GAMES.

Breed.	Variety.
Sebright	Golden.
	Silver.
Red Combed	White.
	Black.
Booted—	White.
Brahma	Light.
	Dark.
Cochin	Buff.
	Partridge.
	White.
	Black.
Japanese	Black Tailed.
	White.
	Black.
Polish	White Crested White.
	Buff Laced.

These diminutive chickens are bred mostly for pleasure. They are general favorites with ladies and children, and are very popular with many breeders, who find them very profitable.

11TH CLASS—MISCELLANEOUS.

Silky—White.
Sultan—White.
Frizzles—Any color.
Rumpless—Any color.

While the varieties included in this class are fair layers, they are bred principally for pleasure, and are usually quite an attraction in the show room.

12TH CLASS—TURKEYS.

Bronze.
Narragansett.
Buff.
White Holland.
Black.
Slate.

Of all the varieties the Bronze seems to be the most popular. The standard weight of adult males is 36 pounds; of females, 20 pounds; and not infrequently specimens have attained 40 or 50 pounds weight for males and 25 to 30 pounds for females.

The White Hollands are much smaller and rank next to the Bronze in popularity, are considered equally as profitable for market purposes, and have many admirers.

Any remarks on the excellent qualities of these fowls for table purposes would be superfluous.

13TH CLASS—DUCKS.

Pekin—	White.
Aylesbury—	White.
Rouen—	Colored.
Cayuga—	Black.
Call	Gray. White.
East Indian—	Black.
Crested—	White.
Indian Runner.	
Muscovy	Colored. White.

All of the varieties are more or less popular. That which is most extensively bred at the present time is the Pekin. The Aylesbury, Rouen, Muscovy, and Indian Runner find favor with many of our breeders, and are bred for market purposes. The Indian Runners are noted for their good laying qualities.

14TH CLASS—GEESE.

Toulouse—	Gray.
Embden—	White.
African—	Gray.
Chinese	Brown. White.
Wild or Canada—	Gray.
Egyptian—	Colored.

The most popular varieties are the Toulouse and Embden. The Chinese are bred to some extent, but the other varieties are bred in very limited numbers.

There is always a good market for geese, and if properly handled they can be bred at a good profit.

The foregoing review of the different varieties of fowls may not prove of great value to the experienced poultryman, but to the "general public" it will prove interesting in showing what progress has been made by practical poultrymen in producing the many different varieties by scientific mating.

That the thoroughbred fowl is superior in every way to the common scrub fowl has been proven by all of the experiment stations established in the Eastern States.

The many excellent poultry journals published in California furnish material for valuable courses in all branches of poultry culture; for comprehensive research, scientific method, and practical utility they are unrivaled by any other publications. Their inestimable value and direct benefit to poultrymen are apparent to all who realize the importance of a scientific education. To them, as well as to the State Agricultural Society, great credit is due for developing and promoting this industry.

There is practically no limit to the extent to which this industry can be developed, and I trust that the State will recognize its importance by making an annual appropriation, as is now done by many Eastern States.

The United States census reports show that in California on June 1, 1900, there were 55,479 farms; the value of poultry being $1,877,489; eggs produced, 24,443,540 dozen, of the value of $5,864,679.

The following were the receipts of dressed and live poultry received over the lines of the Southern Pacific Company from points outside the State during the calendar year 1901: Dressed poultry, 3,363,790 pounds; live poultry, 4,701,660 pounds.

The Chamber of Commerce of San Francisco reports for 1901 the following receipts of eggs from interior California points: 8,564,940 dozen.

RAISING POULTRY IN THE SAN JOAQUIN VALLEY.

By GEORGE ANDREWS, Secretary Fresno Poultry Association.

Should I tell you that if I had all the chickens and eggs that are produced every year in the United States I could buy all the gold, silver, and other minerals mined in the United States in a year, and pay the interest on all the farm mortgages besides, you would probably not believe it. If you were told that one year's product of the hen would buy the entire wheat and cotton crops of this country, you would probably doubt that also. Again, if I told you that the product would equal the total value of the sheep, wool, hog, and potato crops of the land, that would sound "fishy," too. Yet all these are facts.

The total product of poultry, that is, eggs and fowls sold on the market, is estimated, after careful and thorough investigation, as being about $290,000,000 per year.

The question that should interest us most is, "How much of this does our State produce?" Five million dollars' worth less every year than she should. Why? No one perhaps can tell. Every year from two to three million dollars that should stay at home are sent out of California for eggs and poultry, and we should export that much more.

When the farmers wear out the soil of their old farms; when they are settled down like they now are in the East; when all the natural changes have come about; when the land has become so thickly settled that eighty acres will be a big farm for one man to own or manage, and when the people become more settled and not so everlastingly "rushed," then, I think, California will begin to produce more poultry and will be able to supply the home demand and perhaps export a little.

As to the adaptability of the State, and this valley in particular, to the growing of poultry, I can not see why it is not as good as any place in the world. It has many advantages over the Eastern States, and, possibly, one disadvantage. That disadvantage is the heat of summer. The principal advantage is that the fowls can run out of doors all winter, thereby saving a large expense in the way of housing and extra care.

Alfalfa, which is one of the best green foods known for poultry, can be had here green every day in the year, providing green feed, which is expensive in the East, and it is very essential to egg production.

Wheat and Egyptian corn can be grown here as cheaply as in any place in the world.

The winters are never cold enough to freeze the combs or wattles of even the Mediterranean breeds.

A house with a whole side out, just so it has a roof and shelter from prevailing winds, is all that is needed for housing.

In the East, from which we import carload after carload of eggs and poultry every year, houses have to be built with double walls to prevent the birds from freezing.

Land that is too sandy for almost anything else is the best kind of a place for poultry yards, and it can be had very cheap.

Anywhere where water can be had and shade provided poultry will do well. Orchard and poultry make a good combination—the fowls will rid the trees of many worms and insects, while the droppings are a continual fertilizer for the soil.

This year, for the first time in the writer's knowledge, eggs have been shipped from California to the East. Being in the telegraph business, I marveled at the number of telegrams coming to Fresno and surrounding towns inquiring for eggs, and upon investigation learned that they were being bought up and shipped East. Thus the ice seems to have been broken, and California should keep up the movement and soon stop the importation of "Eastern eggs."

"Eastern eggs" are eggs that are bought up in great numbers in Kansas, Missouri, Iowa, Indiana, and other Eastern States, in the summer while they are very cheap, are shipped to Chicago, where they are put in cold storage until the price goes up in winter, and then are taken out and shipped all over the country at prices about three times higher than what they were bought for. If the farmers will only raise enough poultry and properly feed and care for their chickens, as they do for their cows or horses, there is no reason why we could not produce eggs in the winter and early spring, while the Eastern States are yet covered with snow and ice, and ship them East and secure a good price for "fresh ranch eggs," which would readily sell for one third to one half more than "stored eggs."

Hens can be made to lay in this valley during the whole winter to a great extent, and to be doing their best by the first of February if properly cared for; and as fresh eggs are very scarce in the East before April 1st, it surely could be made a paying business.

The hot summer months are quite as severe on poultry as on other stock, but chickens can be profitably kept through the summer if green pasture, plenty of fresh water, and shade are provided.

The breeds that feel the heat most are the Asiatic breeds; that is, Brahmas, Cochins, and Langshans. They are so heavily feathered that they feel the heat more than the lighter breeds, and are therefore not recommended as a profitable fowl for this section. Their principal virtue is in their large size, which on the market, if sold by the pound, would cause them to bring a good price. They are poor layers, and being very large, their flesh is more or less coarse.

The Mediterranean class (that is, Leghorns, Minorcas, Andalusians, and Spanish) are the best layers in the poultry family; but while they are the best layers they are very poor as dressed poultry. They are of small size and their meat is not of the best.

To strike a happy medium between the above two breeds has always been the aim of the ever-progressive Yankee, and the American class, the Plymouth Rocks and the Wyandottes, is the result. Between the Plymouth Rocks and the Wyandottes there is not much difference. The Plymouth Rocks are a little larger, but otherwise about the same. Both are good average layers the year round, while, when dressed for market they are simply the best, their carcasses dressing from five to ten pounds at maturity, and the quality of the flesh can not be surpassed. Their rich yellow skin makes them very attractive as an edible fowl, while their large plump forms leave little to be desired. Taken the year round, they will produce nearly as many eggs as the Mediterraneans, while at testing stations where different breeds have been kept and fed for eggs for a year at a time, the Plymouth Rocks hold the world's record, 282 eggs per fowl per year. This of course is an extreme case, where the best of care and feed was had the whole of the time; but several other breeds had the same care and feed, yet could not come up to the Plymouth Rocks.

Ducks for market will, in my belief, be one of the great exports of this valley in years to come. Ducks, for some unaccountable reason, seem to do particularly well in this valley. Their eggs are of little value except for cooking, as they have a very large yolk, and when broken are very red and have a strong taste which most people dislike; but for cooking they should be preferred to hen eggs, as they are larger and richer.

Mammoth white Pekin ducks can be grown to weigh from five to eight pounds in twelve to eighteen weeks' time, and can be sold as roasters to a good profit if properly marketed. Chinese are great lovers of ducks, and San Francisco could no doubt use all that could be produced, at good prices. Many people are of the opinion that ducks must have water to be raised successfully. Not so. The most successful duck-raisers in the country raise their stock on dry land, and many ducks never have a swim during their lifetime. Some of the best ducks ever shown in the Fresno poultry show were raised without swimming accommodations.

This valley ought to be the broiler hotbed of the Pacific Coast, and for the East, too, for that matter. The winters being so mild, and the warm weather coming so early, would enable the progressive poultryman to put two-pound broilers on the market two months earlier than the Eastern poultryman could. Hens can be made to lay (and the eggs very fertile, too) during the winter, at least in such numbers as to bring out a large number of chicks at almost any time.

Why is California noted as the great fruit State? And why are such enormous prices paid for early California fruits? Simply because her fruits are the first in the market and they bring the very highest prices. Broilers, and eggs as well, could be made to do the same thing, if the people but realized it.

The warm spring days of this valley are the very best for growing chicks, and incubator chicks do not need half the brooding that they require in the East, and consequently grow faster and mature quicker when they have the sunshine to run and exercise in, instead of a close, ill-ventilated brooder.

For poultry-raising this valley is much to be preferred to the coast counties, on account of the fogs that prevail there in the spring, and which are seldom seen here after February 1st.

The poultry business is in its very infancy in this county as yet, there being only two or three yards of any size where poultry is made the principal object.

In conclusion, I would say it would be folly to try and run a modern poultry farm with scrub stock. Many people imagine a "hen is a hen," that a scrub will lay as many eggs as a thoroughbred, that thoroughbreds are delicate, besides numerous other fallacies. Has thoroughbred cattle broken Miss Eshleman's (now Sherman) Minnewawa dairy? What has pure blood done for Palo Alto stock farm? Just as great results can be accomplished proportionately with poultry, if worked right.

Many people think that any one, however inexperienced, can raise poultry. Such people pay dearly for their belief every year. It takes as much experience, thought, study, and careful attention to successfully raise poultry as it does to grow fruit, raisins, or fancy horses or cattle. There are a thousand and one little things that a successful poultryman must know. The raising of exhibition poultry is a science that is only mastered by years of careful study and experiment in mating and mixing of blood. Raising fancy poultry and raising poultry for market and eggs are two quite different things. Each is a field in itself, and each requires different methods of mating, feeding, and care.

Individual chickens have sold for as high as $250, where real sportsmen are interested in the show room. To say that breeding for fancy points is fascinating is really putting it mildly, if a person has any love for the feathered pets. The birds that win the blue ribbons at the show are not picked up on the farm from among the flock, but are usually birds that have had special care for three, four, five, or six generations back, each year being carefully studied and scientifically mated to produce something better "next year," until finally the top is almost reached. There never has been a perfect bird produced, and probably never will be; but the fact that birds raised in Fresno County have been shown against the best birds from all over the State, and against many imported from the East, and have won the blue ribbon, proves conclusively that Fresno County is as well adapted to raising fancy poultry as to raising poultry for market.

BEE-KEEPING IN CALIFORNIA.

By R. H. YEARNSHAW.

The bee-keeping industry in California commenced in 1853 by the introduction of a few colonies brought from the East. In 1856, Mr. J. S. Harbison brought a large shipment of bees from New York, to which he soon afterward added other consignments, nearly all of which were taken to Sacramento. Later, it was discovered that Southern California was an ideal honey location, and it was not long until there were a number of apiaries in that section of the State.

The industry has been successful in this State; that is, with live, energetic men, and women also, barring the few crop failures. Southern California has had three almost total failures—in 1898, 1899, and 1900. The bees have been largely decimated thereby, and now only the most intelligent, energetic bee-keepers have any bees left. The year 1900 was a partial failure all over the State, some favored localities harvesting part of a crop. But in the good years—Ah! that's what would make one's mouth water—*three hundred carloads* were shipped East, hundreds of tons were shipped by water from San Francisco, and tons and tons were consumed in the State. Such a year was 1897, and 1902 promises to be another such a record-breaker.

The future of the industry in the State is very promising. True, the area of the sages in Southern California is getting less and less, but the area of alfalfa in the irrigated sections is being rapidly added to, which will more than counterbalance any loss of other honey flora. Besides, alfalfa is a surer honey-producer—not giving the phenomenal yields of the sages, and never being a total failure.

The quality of California honey is second to none. The honey from sage is clear and limpid, as is also the honey from alfalfa, where perfectly free from being mixed with dark honey. There are other kinds of fine, white honey, but they are apt to be mixed more or less with darker hued honey, which, however, does not hurt the eating qualities.

In regard to locations for honey-producing, only generalizations can be given, as a place may be either overstocked or barren of honey flora, while a few miles in either direction there might be a virgin field, simply flowing with honey. In the San Joaquin Valley from Kern to Merced there are large areas of alfalfa, and where not overstocked would afford excellent locations. The Sacramento Valley also has a great many good locations, some partly stocked. Southern California has a great many good sage locations left yet. All through the State in the hills and small mountain valleys are a great number of openings. In considering location, the closeness of transportation facilities must also be taken into consideration.

The honey flora of California presents a great diversity. Besides the white and black sages and alfalfa, before mentioned, there is a long list of plants that produce more or less honey, including fruit bloom, bur and sweet (or sour) clovers, golden rod, Spanish needle, smartweed, alfilaria, wild lilac, blue tarweed (the yellow tarweed produces rank, black honey), buckwheat, manzanita, buckeye, button-willow, yellow willow, locust, eucalyptus, etc. Some of the above blossom early in the spring, and are more valuable in building up the strength of the bees for a later flow than they are for a crop of honey.

To sum up: After one has found a good location and is willing to work a little, and also has something with which to tide over poor years, he may rest assured that for time and money invested very few industries will yield a better income, at the present prices of honey.

The United States census reports show that California is the second producer of honey, being a very close second to Texas. The yield of honey in California for 1899 was 3,667,738 pounds. The following counties lead in the production: Fresno, San Diego, and Tulare. The State of New York is third in the list of honey-producers in the United States.

The San Francisco Chamber of Commerce reports the yield of honey in California in 1900 as 2,208,000 pounds, and for 1901 as 4,600,000 pounds.

BEES IN THE ORCHARD.

As a contribution to the current discussion of the relation of bees to fruits, the experience of Fred Buck of Vacaville is interesting.

Mr. Buck has two hundred and seventy hives of bees. Bees are, of course, a source of great profit, and on this account should be kept by other orchardists. They get most of their honey from the hills, and during the summer up to the first of July find plenty of flowers in the hills from which to secure food. They also gather considerable honey in the fall, the months of September and October being usually the best months of the fall, although in some seasons they gather a good deal of honey as late as November. They do not damage fruit in any particular. Mr. Buck keeps his hives in a peach orchard.

But the bee industry is deserving of consideration by orchardists from another standpoint. It has been recognized that the pollenization of the cherry blossoms was a necessity. For the purpose of pollenizing the cherry blossoms, it has been deemed advisable to plant different varieties scattered about, and even to mix the wild cherries about in the orchards. With a good many who recalled the big cherry crops of the past in Vacaville, it has been a matter of bee or not to be. They recall the early days of Vacaville, when the cherry crop was unfailing, and persistently urge that wild bees were then numerous. For one reason or another, mountain fires perhaps as much as anything, the wild bees seemed to desert the valley, and just in that proportion did the cherry crop fall below the normal.

Mr. Buck finds that the bee crop is an insurance of the cherry crop. He says that the season of 1901 gave him the biggest crop of cherries he ever enjoyed, when his acreage was only one third as large. He also says that he had at that time the largest number of bee hives. He is positive that the bees are underwriters of his cherry crop, and will not part with them, because, as he says, no bees, no cherries; plenty of bees, plenty of cherries. He says that bees do no harm to orchards or to drying fruits, except that when pears are being dried their sugary sweetness attracts them, and it is found necessary to cover drying pears with netting to keep off the busy bee. Despite this objection Mr. Buck is an enthusiast in the matter of bee culture, and proposes to continue the industry which has been profitable to him directly, and indirectly even in a greater degree.

SILK AND SILK CULTURE IN CALIFORNIA.

BY MRS. CARRIE WILLIAMS, OF SAN DIEGO.

This is, indeed, a subject of deepest interest to the citizens of the "Golden State," because there is money in it—millions undeveloped, only waiting to be called forth to the light of day by wisely applied energy. While wealth and prosperity are not the only sources of happiness, they are undoubtedly large factors in securing much that is desirable in life.

Whatever branches of industry give employment to the masses in any single line of work, without any evil results, or complications to offset the good of providing employment, are certainly more to be desired than those lines of work or business that, while providing occupation in one way, are in another way unfitting a large percentage of citizens for the purest and fullest enjoyments of life. I will only mention two industries in contrast, viz.: silk and tobacco. The use of tobacco follows its production and manufacture; and it is given in the regular lines of statistics that at the present time *seventy-five per cent* of the youth of our beloved land are unfitted for military duty, through the use of the alluring cigarette. From the production and manufacture of silk there is nothing to be feared. It gives legitimate, healthful, pleasant employment to men, women, and children, without the least danger of ever leaving behind a moral, physical, or intellectual blot or stain. The silk industry has enriched every nation that has ever engaged in it, and its history dates back more than twenty-seven hundred years before the Christian era.

As far back as the year 1860 there was in California quite an interest awakened in the production of silk, through the intelligent efforts of Louis Prevost, a Frenchman. He did wonders in demonstrating to the people what might be done with the silkworm in California. He went to France, intending to return with a large invoice of choice silkworm eggs; but unfortunately he was taken sick, and died without carrying out his intention. Thus the industry seemed to be left without a head, and, like all projects in like position, it gradually dwindled down for years. In a measure the industry was revived by the action of the State Board of Silk Culture, and then by the Ladies' Silk Culture Society. With the flight of years, and for reasons I have not now time to mention, both these associations or societies ceased to put forth united efforts in the interests of silk culture.

The climate and soil of California, especially that of the southern portion of the State, combine to make this State stand unrivaled as a silk-producing region. And the mulberry tree, in all its many varieties, embodies more hidden wealth than did all California's gold mines in her early days.

The prerequisites to successful silk culture are a dry, healthful climate for the worm, and a good productive soil for the mulberry tree.

Silk as a business may be classified on three separate lines, viz.: The production of silkworm eggs, the production of silk fiber, and the manufacture of the fiber into silk. Each of these lines will yield to those engaged therein a just recompense for expended labor.

For the silkworm eggs brought into use yearly, many millions of dollars are expended. No country in the world can produce finer or more healthy eggs than California. If intelligent effort were put forth, we might, without very great labor, supply a large portion of the markets of the world. Healthy eggs are the very foundation of the whole silk business. When, less than fifty years ago, the silkworm disease well nigh proved fatal to the great industry, Japan netted to herself $85,000,000 in a few years. Disease still lingers in all the silk countries of Europe. I have heard recently that an Italian capitalist is now in California looking up a location where he can cultivate the mulberry tree, and raise eggs for the European markets. In some localities he found an abundance of mulberry trees, but not so desirable a climate as in San Diego and other portions of Southern California. This one branch of the silk business might be made very profitable to California.

Not only as to climate and soil are we so highly favored, but also as to length of season. While Italy and France count on a silk season of only six or seven weeks, Southern California can count on eight or nine months of each year. It is stated on authority that here trees grow in one year as much as they do in three years in the silk countries of the far-off east. And, too, while the general idea is that the winter months is the best time to put in cuttings of the mulberry tree, experience has proved that they may be planted during all months of the year. The fact of continuous planting gives continuous foliage in the frostless regions, and continuous foliage provides for continuous hatchings of the silkworms.

It has been proven beyond all dispute that silkworms kept in cold storage below 40° Farh. may be taken out just whenever it is convenient to rear them. In 1901, I took from cold storage eggs that had been placed there fifteen months previous, and I found that the worms coming from them were strong and perfectly healthy. But let it be remembered that there is a proper time to put them *in*, and that any deviation from that time will surely prove fatal.

Fifteen to eighteen hundred pounds of leaves will feed for life 40,000 worms, which is the product of one ounce of eggs.

The use of silk has been on the increase for more than four thousand years. Within the last decade the increase has been at least tenfold; and every year adds fresh impetus. Before, and for some time after the Civil War, the United States manufactured only fifteen per cent of all the silks we used. Now the American people manufacture eighty-five per cent of the silks used in this country. Not only has the output for home use been so largely increased, but our manufactures are placed in competition with the work of all other nations. As a result, the Richardson Silk Company, of New York, manufacturers of sewing and embroidery silk, took the first premium at the Paris Exposition ($5,000 and three gold medals).

Now, this increase in the quantity and quality of silk manufactured in the United States is not in any way due to conditions of the country being better adapted to the manufacture of silk; nor is it due to the influence of cheap labor, as is shown by the following statement by Mr. Cheney, president of the Silk Manufacturers Association, who said that their employés are paid "about twice as much as in England, three times as much as in France, three and a quarter times as much as in Italy, and probably ten times as much as in China and Japan." (Revision of Tariff, Jan., 1890, page 606.)

Thus we see that the advance of silk manufacture in the United States has been very rapid during the past few decades, yet no special reason can be given, except that the enterprise and superior inventive genius of the American people seemed to lead them into it.

Why is it, then, that people do not more largely engage in the production of silk when there are so many advantages in its favor? There is no mystery about the rearing of silkworms. The exercise of common sense and good judgment is the one thing necessary, as it is in all things where success is achieved. The production of silk must be made to radiate, not to concentrate. There must be in every State a grand center adapted to the business. Large tracts of mulberry trees must be planted and be under the care and guidance of efficient helpers. It is no use to try to establish the silk industry anywhere by simply making it an amusement, by having a few trees and a few worms to feed or starve at the will or caprice of the owner. No, this will never do. Small lines may flow into large lines, and thereby increase the general whole, but large lines are called for imperatively, and into these, when once established, all the smaller lines will continuously flow, to the benefit of all concerned.

The retail cost of the silk and silk goods of the world is about $600,000,000. The Silk Producers' Association of Lyons gives the world's output of reeled silk for 1890 at 34,583,555 pounds. This does not include Australia or North and South America. Multiply these figures by $4, which is a fair average price per pound for reeled silk, and $138,334,220 is the result. Deduct this amount from the retail price paid for silk, and $427,082,225 remains. This balance goes to the manufacturers and merchants. Surely this sum is worth looking after.

A few years ago there were but four hundred silk factories in the United States. Now there are more than nine hundred. These are distributed in nineteen different States, principally in the Eastern States. In California there is but one small factory (so far as I know) where silk goods are manufactured, and that is in Oakland. The Carleson-Currier Company, of Petaluma, I believe make only underwear, hosiery, and sewing and embroidery silk.

The November, 1901, report of the Silk Association of America shows that the total New York importations of silk goods in that month (five weeks) amounted in value to $2,271,229, as compared with $1,789,118 in November, 1900. The free raw materials brought in were valued at $1,429,356. A very large percentage of this raw material was reeled silk, which is twenty-five per cent manufactured, but which now, and ever since the Civil War, comes in free of duty. These irregularities should be looked after by our Representatives in Congress when the question of the tariff is being discussed. Our exports in silk are on the increase, also. In 1900 they amounted to $214,481, and in 1901 to $236,924. Though the increase is small, it is significant.

Last year Cuba purchased $526,000 worth of silks, of which we furnished but $24,000—less than five per cent. Yet, if her people had had due instruction in the principles of silk production and manufacture, she might have exported far more, and still retained enough for home use. And in like manner very many of the isles comprising our newly acquired possessions might bring to the nation their quota of self-supporting surplus ability.

We claim to be the most advanced nation on the earth. The history of our nation, as it is being written, proves that we have indeed a very important part assigned us in the world's evolution. Education is the pivot around which all great movements turn. This being our destiny, who can for a moment doubt that the American people will yet attain a higher and greater degree of excellence, both in the production and in the manufacture of silk, than has yet been reached by any other nation? Here in California we have all the essentials necessary to make this State the grand emporium of the world for the silk business, from the precious seed to the most elaborate and highly finished designs sent forth from the most complicated machinery.

For further information I refer you to the following treatise: "Complete instructions in rearing silk worms, care of millers, and preservation of eggs; also how to build and furnish cocooneries, to plant, prune, and care for mulberry trees, together with much valuable information as to the silk industry in general," by Mrs. Carrie Williams, sericulturist, of San Diego, California.

SUGGESTIONS RELATIVE TO LIVESTOCK EXHIBITS.

By JAMES WITHYCOMBE.

Corvallis, Oregon, April 14, 1902.

To the Honorable State Board of Agriculture, Sacramento, California:

Gentlemen: Perhaps a few suggestions relative to exhibits in some classes of stock, from one who has had the honor to act as judge at the California State Fair, might not be amiss. At the outset permit me to compliment the management of this fair for its clean-cut business methods in its dealings with both exhibitors and spectators. The California State Fair is one of the best conducted fairs that I ever had the pleasure to attend, although a few criticisms will be interspersed with my expressions of commendation.

The display of livestock in the item of numbers is not commensurate with the great possibilities of the livestock industry of the State. This is the fault of the farmer, for no just complaint can be made against the very liberal premiums offered or the treatment accorded by the association; neither of the cost nor of the facilities for the transportation of the livestock to and from the Fair. It is probably an unconscious inertia on the part of the stock-breeder. California should be equally as famous for the numbers and superiority of her cattle, sheep, and swine as she is for her fruits, cereals, horses, and minerals. Stock-growing is the corner-stone to successful agriculture. The farmer, however, must remember the fact that it costs no more to maintain an animal which will yield the maximum returns in dairy products, meat, or wool, than it does to maintain one yielding the minimum returns. There is an existing relationship between form and function, hence the stock-breeder, to be successful, must study the various types of breeding-animals. An annual pilgrimage to the State Fair, where animals of individual excellence can always be found, affords an excellent opportunity for this work. What is still better, if you are a breeder, is to bring along your best animals and enter them in competition with the product of the skill of other breeders. There is no school like this for giving a practical demonstration. Agricultural fairs are educational to the highest degree when competition is large and keen and when the awards of premiums are made by competent persons. However, no complaint can justly be made against the educational features of the California State Fair. While some of the breeds of domestic livestock are not represented in large numbers, the excellence of those usually found on exhibition fully make up in quality what may be lacking in numbers. These deductions were formed from observations made during three annual visits to the Fair. The dairy breeds and swine were exceptionally strong, both in point of numbers and in quality. The beef breeds were well represented, very notably so by those forwarded by breeders in the adjoining State of Nevada.

Breeders should have high ideals relative to the individuality of their stock. The scales and Babcock test are the crucial test for the dairy cow, and the butcher's block for the meat-producing animals. Animals bred for specific purposes should possess a distinctive type. The head is usually a good indicator of the form and disposition of the individual. For example, the rather long, clean-cut, refined head of the dairy cow is generally accompanied with a thin neck, sharp withers, a broad, thin loin, flat, thin thighs, and a capacious udder. The short, broad, meaty head of the beef animal is generally supplemented with a deep, thick carcass, heavily padded with flesh. The broad snout, short face, and heavy jowl of the hog are generally indicative of a well-developed frame, affording arched ribs, broad back, and large hams.

In conclusion, I trust that the cattle, sheep, and swine breeders will manifest their appreciation of the praiseworthy efforts so intelligently directed by their State Board of Agriculture for the upbuilding of the livestock interest of the State by making larger exhibits, and thus aid in the development of one of the most important branches of agriculture.

I beg to remain,

Very truly yours,

JAMES WITHYCOMBE,
Director Oregon Experiment Station.

CONTAGIOUS AND INFECTIOUS DISEASES IN ANIMALS.

By DR. CHARLES H. BLEMER, State Veterinarian.

BLACK-LEG.

Black-leg, symptomatic anthrax, or quarter-ill, was formerly supposed to be a form of anthrax, but it is now known to be an entirely different disease and due to different germs. Black-leg is caused by a specific bacillus, which enters the body sometimes by means of the food or drink, but usually through scratches or wounds in the skin. The spores of this germ are very hardy, and will live in a dry state for a long time. They are easily carried from one ranch to another by animals or man, and also can be distributed by running water.

The symptoms of black-leg are characterized by its very rapid spread, which, with but few exceptions, ends in death in from one to three days. It is characterized by a rapidly increasing swelling of the skin, which crackles on being touched, due to the gas contained in the tumor. The swellings may appear on different parts of the body; they are generally found on the upper parts of the thighs, neck, shoulders, and the lower parts of the chest and loins, but never appear below the hocks or knees. The swellings are at first very small and painful, but rapidly spread and obtain unusual size, often extending over the whole trunk; they become cold, and no pain is felt by the animal when an incision is made into them. After an incision a dark red, frothy, unpleasant-smelling fluid flows from the wound. The general symptoms are suppression of appetite and rumination, high fever, lameness, and drawing of legs; breathing becomes difficult also.

The post-mortem examination discloses the tissue in the region of the swelling to be infiltrated with blood and containing bubbles of gas. The muscles surrounding the tumors are of a dirty brown or even of a black color. The blood is of normal color, but easily coagulates. The spleen is unchanged.

Black-leg is clinically distinguished from anthrax by its characteristic crackling and tumors containing gas, which never occur in anthrax, and by the normal condition of the blood and the spleen.

This disease affects cattle, sheep, and goats. The cattle commonly affected range in age from three to eighteen months. Occasionally calves under three months and cows over two and a half years old are affected, but this is the exception.

Owing to the rapid and violent course of the disease, treatment is of little value. Various kinds of remedies and methods have been tried, but without success, and in many instances worthless substances have been placed on the market and sold as preventives. Setoning, rowelling, bleeding, etc., are often practiced, but the blood and serous fluid carrying germs of the disease are in this way scattered over the ground, thus endangering the lives of the well animals. The only method of combating the disease is to prevent it by vaccination.

Vaccination was first introduced by the French scientist Arloing, in 1883. Arloing's methods were improved upon and modified by Kit, the germ scientist, and his latest process is the one universally adopted.

During the last fifteen years many million head of cattle have been vaccinated, with great success. The cost per dose is so insignificant and the results are so satisfactory that vaccination is looked upon as indispensable by cattle-raisers. The process of vaccination is simple and can be carried out by any intelligent stockman, and immunity usually lasts a lifetime.

Relative to the age of susceptibility, the following statistics are given: One half of 1 per cent of deaths occur before one month old, 8 per cent occur between one and two months, 13 per cent between two and three months, 38 per cent between three and four months, 41 per cent between four and five months old. Before five months old, calves are usually classed as six months old, so that statistics between the months of five and six are unreliable. The most susceptible age is between six and eighteen months. This being the case, the safest method would be to vaccinate between the ages of three and four months.

During the past five years many million doses of black-leg vaccine have been manufactured and sent out for experimental purposes by the Bureau of Animal Industry of the United States Department of Agriculture, Washington, D. C.; and statistics obtained by this Department and those compiled by chemists such as Park-Davis Co. of Detroit, Mulford Co. of Philadelphia, Pasteur Co. of Chicago, and the Cutter Analytical Laboratory of Fresno, Cal., prove conclusively that vaccination is a positive preventive of this disease.

ANTHRAX.

Anthrax, or charbon, is perhaps the oldest known and most fatal disease of animals. It attacks all animals, but most frequently cattle; it is also communicable to man. It appears to be alluded to in the second book of Moses (ix:10) as the sixth plague of Egypt. In the third book of Moses stress is laid on the possibility of transmitting the disease from clothes to man. An epidemic which was described by Homer in the first book of the Iliad, and which raged among men, mules, and dogs, seems to have been anthrax. The symptoms vary in different species of animals and also in individual cases, as to whether the intestinal canal, skin, lungs, etc., are infected.

In pre-acute or apoplectic anthrax the animal becomes suddenly ill, and dies in convulsions after a period of illness varying from a few minutes to an hour at most.

In acute anthrax the course is somewhat slower, and lasts from two to twenty-four hours. The animal becomes feverish and shows either congestion of the brain or congestion of the lungs. In the former, the general symptoms are restlessness, rearing, bellowing, running to and fro, convulsions, and death. In the latter, difficult breathing, wheezing, bloody discharge from the natural openings of the body, and finally death by suffocation.

The sub-acute form is termed anthrax fever, and is the ordinary kind which attacks horses and cattle. The symptoms are generally the same as in the acute form, except that they are more clearly defined and their course is longer—one to seven days.

The forms of anthrax with visible localization appear first as carbuncles and swelling of the skin, which is known as a carbuncle disease. It occurs more frequently in horses and cattle. Carbuncles and swelling of the mucous membranes of the mouth and throat is the form most frequently seen in dogs and pigs.

A post-mortem examination shows the spleen or melt to be from two to four times its natural size, and the blood is thick, blackish, and dark.

Anthrax is distributed all over the world and in nearly every country. It is chiefly met with in districts where the soil is boggy and swampy, and the germ will live for years in such localities.

As in black-leg, the treatment is very unsatisfactory, as there is at present no known cure. The only way of combating anthrax is to prevent it by vaccination, which is equally as successful as in the treatment of black-leg.

VERMINOUS BRONCHITIS OF CALVES.

While in no sense a new disease, until recently it has not been brought to the attention of livestock sanitariums. This disease has no doubt existed in California for several years. It is very often overlooked, or diagnosed under another name. It is known to have existed in several sections of this State—in Los Angeles, Fresno, Humboldt, Del Norte, Sacramento, and other counties.

A prominent Los Angeles veterinarian stated that he believes the disease had existed in that county for several years, but was pronounced as being distemper, no one having taken the trouble to make a thorough post-mortem examination until recently, when the true cause was discovered.

The cause of this disease is recognized as a hair-like worm from one half to three inches in length, which inhabits the bronchi or bronchial tubes.

The symptoms are an infrequent, dry cough, which gradually increases, becoming strong and husky, and ending in paroxysms and suffocation as the disease advances. Mucus streaked with blood and then worms are finally expelled from the mouth and nasal cavities. The animal, through loss of nutrition, etc., rapidly becomes weak and emaciated.

It is believed that the embryos do not develop in the host, but must necessarily be expelled to pass the first stages of their existence. They live in water for an indefinite period, and it is said that a dried embryo, under certain conditions, will revive when placed in water. No satisfactory theory has ever been given as to how the worm enters the bronchi, but the *infection*, in all probability, takes place through water or food, such as damp grass.

Internal treatment, inhalations, and inter-tracheal injections have been used as treatment for this disease. But such experiments as we have had show that inhalations combined with tonics are more satisfactory; but, owing to the hardiness of the worm, treatment of any kind has not been of much benefit. Inter-tracheal injections of chloroform, turpentine, carbolic acid, etc., apparently relieve the infected animal, but abscesses are apt to follow when any of the fluids get into the tissues. Chloroform or ether combined with oil of turpentine and amber, equal parts, with a little formaldehyde as an inhalation, gives the best results; pour one or two teaspoonfuls into the nostrils, lift the head, and allow it to vaporize. Stimulating tonics, for the purpose of arousing digestive functions, aid recovery.

The preventive measures to be taken against this disease are rather uncertain, due to our ignorance of the life history of this parasite. However, the draining of damp pastures and the destruction of animals which have succumbed to this disease are of the utmost importance, and calves should be kept from infected pastures.

GLANDERS.

Section 402½ of the Penal Code of the State of California is as follows:

"Every animal having glanders or farcy shall at once be deprived of life by the owner or person having charge thereof, upon the discovery or knowledge of its condition; and any such owner or person omitting or refusing to comply with the provisions of this section shall be guilty of a misdemeanor."

Let it be understood at the beginning that glanders and farcy are one and the same disease, differing only in that the first term is applied to the disease when the local lesions predominate in the internal organs, especially in the lungs and the air tubes; and that the second term is applied to it when the principal manifestation is an outbreak of the lesions on the exterior of the skin of the animal. The term glanders applies to the disease in both forms, while the term farcy is limited to the visible appearance or external trouble only; but in the latter case internal lesions always exist, although they may not be evident.

Glanders is a contagious, constitutional disease of the genus *equus* (horse, ass, and mule), and is communicable to man, sheep, goats, dog, cat, rabbit, and guinea pig. The course is variable, eventually producing the death of the affected animal. It is characterized by the formation of neoplasms of connective tissue, or tubercles, which degenerate into chancres or ulcers, from which exudes a peculiar discharge. It is subject to various complications of the lymphatic glands, of the lungs, testicles, internal organs, and the subcutaneous connective tissue.

Symptoms: The beginning of chronic glanders is often insidious and passes unobserved. The first symptom is generally a discharge of a whitish-gray mucus from one or both nostrils, the quantity of which is variable, and may even disappear at times. This discharge is frequently streaked with blood. Small tubercles, ulcers, or nodules may be discernible on the mucous membranes of the nostrils. These may be just inside the wings of the nostrils or on the septum which divides one nasal cavity from the other, and may be easily detected; or they may be higher in the nasal cavity, or form in the larynx, windpipe, or lungs. On healing, the chancres on the mucous membrane leave small, whitish, star-shaped scars, hard and indurated to the touch, and which remain for almost an indefinite time.

The eruption of the ulcers and discharge soon cause an irritation of the neighboring lymphatics; and in the intermaxillary space, deep inside the jaws, we find an enlargement of the glands, which become hard and nodulated and adherent to the base of the tongue—an important symptom in diagnosing this disease.

Glanders can only be combated with any efficiency by preventive measures, and by strict application of sanitary police measures which prescribe laws and regulations for the destruction of affected animals.

TUBERCULOSIS.

Tuberculosis is an infectious and contagious disease, produced exclusively by the *Bacillus tuberculosis*, discovered by Koch in 1882. The mode of infection of the organism and the evolution of the tuberculous process are not the same in all animal species. It is principally through the lungs and intestines that the tuberculous bacillus reaches the organism.

Tuberculosis of the ox is one of the oldest diseases which has been mentioned in domestic animals. Moses, in his laws, forbade the consumption of the meat of animals which were affected by "phthisis." Numerous measures relative to this disease are to be found in the Talmud, and particularly in the Gemara (fifth century after Christ), where frequent mention is made of "Kandi timari," which expression is considered as synonymous of "*tubercle*." In 1370, in Munich, the sale of tuberculous meat was forbidden. In 1677, twelve scholars of a Leipzig school died of tuberculosis contracted by the consumption of infected meat.

The penetration of the bacillus into the organism may take place in healthy mucous membranes. Certain predisposing influences, which were formerly considered as essential causes of tuberculosis, favor infection; such are, mainly, insufficient, watery food, which is poor in protein (malt), also narrow, poorly ventilated stables. The catarrhal affections of the respiratory mucous membrane favor the entrance of the bacillus, especially when the morbid secretions remain in the bronchi. The lacteal secretions of numerous gestations predispose also to tuberculosis by weakening the organism, rendering it less resistant to the attack of virulent elements. In breeding, predisposing a degeneration of class will also favor the invasion of the system by the tuberculous agent. Finally, there seems to be a native predisposition created by transmission of the weak constitution of the mother to the young.

Tuberculosis is the most common disease of the bovine species. It is found in nearly all countries, especially in the neighborhood of cities. The proportion of tuberculous bovines varies according to the countries. In Bavaria during 1877–78 it was 1 to 2 per 1000. There are districts where it is more frequent. In the Hollandish breed the proportion of tuberculous animals is said to reach 50 per cent (Nathusius). In Holland, 20 per cent. In some provinces of Prussia, viz., Hohenzollern and Pomerania, 50 to 60 per cent.

The general prevalence of this disease is not realized, the reason being that no general statistics of this nature have ever been gathered in the United States. In Europe accurate records are kept. In northern Europe records show 55 per cent of the cattle tuberculous. In Mexico, 38 per cent of the cattle have the disease. In Massachusetts, 28 per cent of the slaughtered cattle are affected; in New York, 11 per cent; and in other Eastern States an average of 18 per cent; the whole of the United States being estimated at 20 per cent.

When we contrast tuberculosis with other diseases that are even more dreaded, we may see how formidable an enemy we have. Typhoid and scarlet fevers are responsible for about 2 per cent of the deaths; diphtheria and pneumonia, less than 5 per cent, and smallpox is scarcely to be considered; while deaths from tuberculosis amount to almost 20 per cent of the death-rate, and it is estimated that one third of all the deaths occurring in the medical wards of the hospitals are due to tuberculosis, and that one fifth of all surgical cases treated are tubercular.

It is only a few years ago that consumption was recognized as a contagious disease, and the factor of predisposition, as determined by heredity, was considered paramount. A person in robust health may be placed in contact with the germs of tuberculosis and throw them off; and nearly every one is at one time or another susceptible, and escapes or becomes a victim accordingly as he is free from or exposed to contagious influences. A mother and her babe, for instance, may die of consumption, and heredity is blamed. But does the child inherit the bacilli, or imbibe them in the milk (where they are repeatedly found); or are they inhaled as the mother bends over the child and smothers it with kisses? Again, brothers and sisters drop off one after another, and it is said that consumption runs in the family. But we would seek another explanation if the deaths were due to scarlet fever. If you find the tubercle bacilli in the dust on the window casings, in the carpets, bedding, wall-paper, etc., of the dwellings inhabited by persons suffering from consumption, is it not rational to suppose that to these are due the successive deaths of the occupants?

It is known *positively* that tuberculosis is infectious and contagious, and, therefore, a preventable disease. The bacilli are thrown out with the sputum, and this when dried and pulverized may contaminate the air and affect other individuals. Bacilli in sputum retain their virulence, under ordinary circumstances, when expectorated on streets, sidewalks, etc., for from eight to forty-eight hours. To prevent infection all sputum should be burned. This can be done by quarantine. Tuberculosis, affecting practically all of the lower animals, is the same as in man, and is transmissible one to the other. This fact is of the greatest importance from a sanitary point of view, for we have in particular to consider the suitability of the milk and flesh of tuberculous animals for human food.

Every dairy animal in the State should be submitted to the tuberculin test, and every reacting animal should be marked with the recognized "condemned" brand. A State law should make it a felony to milk any such condemned animal; thus we would protect infants and invalids, who are more directly susceptible to tuberculosis. Every abattoir and slaughter-house should be under the inspection of a competent sanitarian, who should inspect all meats thoroughly, and that which is unfit for human consumption should be destroyed.

The prevalence of tuberculosis in animals is not realized by the majority of people. Statistics show that from 2 to 18 per cent of all cattle examined by various boards of health were tuberculous; from 2 to 4 per cent of the hogs; 1 per cent of horses; and 3 per cent of dogs. It is quite common in cats, also in chickens and other fowl; but is somewhat rare in sheep—two tenths of one per cent.

It is known that tuberculosis can be transmitted by the consumption of the flesh of tuberculous animals and by the use of tuberculous milk and its products, butter, cheese, etc. Such meat and milk are sold every day for human food. This can be prevented, and proper measures should be taken to do so.

It is eminently necessary that our farmers and dairymen should understand that this disease is in their midst, and probably increasing here as rapidly as elsewhere. A disease of this sort can be easily mastered in the beginning, and from an economic standpoint the necessity of dealing with the subject by the tuberculin test and isolation of some sort should not be overlooked. But if they shut their eyes to the condition of things, and are willing to let the matter run on year after year without recognition or attempt to crush it out, they may expect beyond question that the problem will increase in seriousness, resulting not alone in great monetary loss to themselves, but also in the transmission of a most malignant scourge to innocent human beings.

SPLENETIC, OR TEXAS, FEVER.

A disease which causes much heavier direct losses than pleuro-pneumonia, and which is almost equally feared by cattle-owners, is known by the local name of Texas, or Spanish, fever. This disease, which has numerous popular and local names, has more recently been called by different writers splenetic fever, southern fever, and tick fever.

When investigations of this disease were first entered upon by the United States Department of Agriculture there were the most profound ignorance and skepticism in regard to its nature and even its existence. Cattle-owners in the Southwest and Middlewest asserted that the herds from the Gulf coast of Texas carried with them a poison that destroyed nearly all the cattle with which they came in contact. So virulent was this poison declared to be that cattle which were simply driven across the trail of the Gulf-coast herds, thirty, sixty, or even ninety days after they had passed, would still contract the disease in the same proportion and in as fatal a form as if they mingled directly with the Southern animals. To these assertions were added others to the effect that the Gulf-coast cattle were healthy, and that the susceptible cattle to which they were said to have conveyed a disease which they themselves did not have were, even when fatally affected, unable to transmit the malady or disseminate the virus to any other cattle.

A few observations of a similar nature had been made in the Eastern States. Cattle from North Carolina and South Carolina, though apparently in good health, had caused outbreaks of disease among the cattle of Virginia, Maryland, and Pennsylvania, which had mingled with them or grazed along the roads over which the Carolina animals had been driven.

The general features of this disease, as described by the various observers, were so unusual, so entirely different from what were seen in any other known communicable malady, that the correctness of the observations was not generally accepted by scientific men, and perhaps the majority of stockmen were of the opinion that the malady was the result of some local conditions, and was incorrectly attributed to poison disseminated by the Southern cattle. The cattle-raisers of Texas were indignant at the charge brought against their herds, which they asserted were as healthy as any in the world, and, not having a disease, could not convey one.

The allegations and discussions in regard to this mysterious disease were almost forgotten, when, in 1867 and 1868, the herds of the Gulf coast had recovered from the destructive effects of the war and appeared upon the markets and feeding-grounds of the Northern States in great numbers. With the warm weather of summer there appeared a remarkably acute and fatal disease among the native cattle in the sections where the Southern animals had been grazed and marketed, which threatened the utter destruction of the native herds, and even of the milch cows kept in the vicinity of the stockyards of the principal market cities.

These serious and widespread losses demonstrated conclusively the reality of the disease, while careful observations and elaborate reports made by Professor Gamgee for the Department of Agriculture, and by the boards of health of New York and Illinois, served to collate and record all that was then known of the symptoms, mode of transmission, the general characteristics, and the changes found in the several organs upon post-mortem examination.

The problem presented to the country was a most important one. There were millions of cattle in Texas, Louisiana, and Mississippi seeking a market, and other millions of cattle in the more Northern States liable to destruction by this fatal infection which they carried. The ranges of the West and Northwest needed these Southern animals to consume their grass, and vast herds were driven through Kansas and Colorado, Nebraska and Wyoming to the most northern limits of our territory. The owners of cattle along these trails were heavy losers from disease, and hence there was an effort to confine these infectious herds to narrow trails, or even to close the trails entirely. This action was resented by the Southern men, who still were not convinced that their cattle caused disease, and who looked upon these restrictions as efforts to avoid competition and prevent the marketing of the herds from the prolific ranges of the South. The time had come when it was necessary for the Federal Government to assist both parties. It was essential to protect the Northern herds from destruction, and scarcely less important to provide for the marketing of the Southern cattle.

Another danger threatened the cattle industry in connection with this disease. Our export trade in live cattle, which was giving an important outlet for our surplus stock, was looked upon by foreign governments with suspicion. It was feared that Texas fever might be introduced among the cattle of Europe and added to the numerous plagues that they had struggled with from time immemorial. The limitation to the spread of the disease, due to the failure of the sick animals to transmit the infection, and the eradication of the disease in newly infected districts by the frosts of winter, were characteristics so unusual that they were not accepted as correct. As a great cattle-producing nation, we could not afford to allow the foreign markets to be closed against us. The Texas fever question was, consequently, one of the most momentous ones which confronted the Bureau of Animal Industry at the time of its organization.

The first step toward the control of this disease was evidently to ascertain the exact extent of the district from which cattle carried infection. To determine this, three classes of facts were available:

First, the history of the cattle which had caused outbreaks of disease could be traced, and it could be learned where they originated; second, by diligent inquiry many sections could be discovered where cattle taken from the North were affected with the disease called "acclimation fever," a disease which we had found was identical with Texas fever; and, third, it could be determined by observation and experiment whether the cattle of any particular section were susceptible to the disease, and if they contracted Texas fever upon exposure to cattle from the known infected district, that fact was evidence that the district in which they were raised was not infected. By a diligent collation and study of such facts the border line of the infected district was traced from the Atlantic coast in Virginia to the Pacific coast in the vicinity of San Francisco, a distance, allowing for the departures from a direct course, of about 4,000 miles.

The scientific study of the disease had not been neglected, and it was found that the infectious cattle could be shipped to market without endangering other animals, provided separate pens were set apart for them at the stockyards where they were unloaded, and provided the cars in which they were shipped were properly cleaned and disinfected. The settling of the Western States and the construction of railroads led to the marketing of cattle from the infected district without much driving, and the trail was gradually abandoned except during the winter months.

The regulations of the Bureau of Animal Industry hastened this solution of the difficulty. The border line of the infected district was made a quarantine line. No cattle were permitted to cross this line between February 15th and November 15th, except for immediate slaughter. The cars carrying such cattle and the waybills accompanying them were marked to show the origin of the stock, and when the destination was reached the animals were unloaded into quarantine pens and the cars were disinfected under the supervision of an inspector. From November 15th to February 15th (changed to January 15th for 1898) the movement of cattle was allowed without restriction. By these comparatively simple measures the dissemination of the disease was almost entirely prevented, and the cars and stockyards used for Northern and export cattle were kept free from the contagion.

In this manner the most urgent problems in connection with the disease were solved, but others of great economic importance still remained. Buyers took advantage of the fact that the Southern cattle must be sold for immediate slaughter, and would not pay as much for cattle in the quarantine pens as they would for the same class of stock in the free pens. Hence, the regulations were more or less of a hardship to those who produced cattle within the infected district. Again, cattle taken from the Northern States to the infected district for breeding purposes and to improve the native stock were subject to the disease, and from 75 to 100 per cent would die the first year. This was very discouraging to the breeders of that section, who desired to produce the most improved varieties of cattle, but who were prevented from doing so by the presence of this infection.

The peculiarities of Texas fever made it a most difficult disease to investigate, and it seemed at times as though its mysteries could never be fathomed. By diligent and persevering observations the Pathological Division discovered in the blood of diseased animals a microscopic animal parasite which lives within and destroys the red-blood corpuscles, and is evidently responsible for the causation of the malady.

It was also discovered that the Southern cattle tick (*Boophilis bovis*) carried this micro-organism from the infectious cattle of the South to the Northern susceptible animals, and that when free from the tick the Southern cattle were harmless.

The actual cause producing this disease in susceptible cattle is a very minute parasite or one-celled micro-organism (*Pyrosoma bigeminum*), which inhabits the red-blood corpuscle.

In an acute attack of this disease a large portion of the blood corpuscles will be destroyed within two or three days; and it is this rapid destruction of corpuscles which accounts for the condition of the liver and spleen, and the thin, watery condition of the blood so noticeable on post-mortem examinations.

Symptoms: The acute form of Texas fever is that seen chiefly in the hot summer months. It appears suddenly, and where it attacks a herd of susceptible animals, they all become affected almost simultaneously. If the temperature be taken by the clinical thermometer, it will be found that the fever precedes the outward symptoms by several days. The animal becomes sluggish, stupid, depressed, the head drops, the ears are down, the animal gradually getting weaker as the disease advances. The brain symptoms, when present, are manifested by partial loss of vision, delirium, staggering gait, etc. Trembling of the muscles may be observed, especially of the hind quarters, when the animal is standing. Torpidity of the bowls is, as a rule, present during the fever. Hæmoglobinuria, or "bloody urine," may be said to be present in most acute fatal cases of Texas fever. Thinness of the blood is another characteristic of the disease.

The duration of the disease varies more or less, but the continuous high fever rarely lasts longer than eight or ten days. In those animals which recover, the falling of the temperature marks the end of the destruction of red-blood corpuscles.

The most prominent changes to be found on post-mortem is the thin, watery condition of the blood; the enlarged spleen or melt, which in acute cases is from three to four times its normal size; the gall bladder is generally full; the urine in the bladder is of a red, bloody color; and the hard, impacted condition of the stomach.

There are several species of tick, but *Boophilis bovis* is the most abundant, and aside from its importance in conveying this disease, it becomes so numerous in some States as to prove a pest to livestock.

This species must not be confused with what is commonly known as the "dog" or "wood" tick (*Dermocenter americanus*), which is found in both Northern and Southern States, and may be found in localities where the cattle tick is common.

A very common tick in Southern States is the Lone Star tick (*Amblyoma unipunctata*), characterized by a white spot just back of the head.

Another tick, spoken of also as a "wood tick," is found in this State (*Dermocenter occidentalis*), and resembles the cattle tick, but is more active in movement (when picked from the animal, and allowed to crawl on a table, etc.), and has a much heavier, thicker leg, and a larger head than the cattle tick.

In a bulletin issued by the Bureau of Animal Industry in 1893, it was shown that the cattle tick is the sole transmitter of Texas fever, and that when Southern cattle had been completely freed from ticks they might be brought into the non-infected territory without danger of communicating the disease to the Northern cattle. The same bulletin suggested a means to free the cattle from ticks, namely, to pass them through a disinfecting bath, or, as it is now termed, to dip them.

The first dipping vat to be built in this country was constructed by R. J. Kleberg, manager of the Santa Gertrudes ranch in Nueces County, Texas, who used it for treating his stock for mange and itch. For this purpose the cattle were dipped in a strong solution of carbolic acid, and it was soon noticed that a large number of the ticks which infested the cattle became severely affected by the dip. Mr. Kleberg then placed his dipping vat and also his ticky cattle at the disposal of the Bureau of Animal Industry, and during the following five years, with the object of testing the tick-destroying properties of various disinfecting preparations, there were dipped at this ranch more than twenty-five thousand cattle. The important fact was learned during these experiments that the ticks were better able to resist these preparations than the cattle. As an instance showing the resistance of the tick to strong disinfectants, it may be mentioned that a solution of corrosive sublimate in water (1 to 250) does not in the least affect the tick when left in it for several minutes. The same is true of carbolic acid, arsenic, lime and sulphur, and a great many proprietary sheep dips.

Dr. M. Francis, of the Texas Agricultural Experiment Station, was the first to suggest the use of an oil dip. Common experience teaches that any kind of grease or oil will destroy the ticks when applied to cattle infested with these parasites. A layer of two or three inches of cottonseed oil was floated on water, which filled the vat to a depth of about five feet. When the cattle were immersed in such a bath they would, as a rule, come out well covered with oil; but it was soon found that many ticks survived the dipping, even when 10 to 15 per cent of crude carbolic acid was added to the oil.

About the middle of 1897 great interest was being taken in the dipping question in various States, and stockmen everywhere began to realize that it would be of immense economic importance if a satisfactory dip could be discovered.

The results previously obtained indicated that a light mineral oil would be most likely to have the desired effect on the ticks, and hence experiments were inaugurated at Fort Worth in order to test some of the so-called paraffin lubricating oils. These oils, which are derived from crude petroleum after the more volatile substances, as benzine, gasoline, and kerosene, have been distilled over, were used in a layer varying in depth from a few inches to one foot on water in the dipping vat, and it was found that their effect was superior to anything which had hitherto been tried. It was observed that the vegetable oils, as well as the crude mineral oil, had merely a mechanical effect, in that they close up the pores of the skin of the parasites; the paraffin oil had in addition a decided chemical action.

While the experiments with paraffin oil were very encouraging, a small number of ticks survived, however; and, the weather being extremely warm, the oil had a more severe effect on the cattle than had hitherto been experienced. For these reasons the experiments could not be considered an unqualified success.

In the meantime experiments are being continued in order to determine if the dipping fluid can be modified so as to reduce the injury to the stock without vitiating its tick-destroying properties.

Prior to 1899 the entire State of California was, on account of this disease, south of and below a quarantine line established by the Bureau of Animal Industry, U. S. Department of Agriculture. In 1899, by the establishment of a State quarantine line, and proper regulations for maintenance of same, one half of the State was reclaimed; and in 1901, thirteen additional counties were reclaimed from the Federal restrictions.

Every endeavor is being made to ascertain, quarantine, and, by the strictest sanitary regulations, eradicate such infection as exists in this State. By reclaiming territory as fast as we can, we ultimately hope to see the entire State free from restrictions.

Since I have been in the position of State Veterinarian it has been my endeavor to effect the organization of a State Livestock Association. Such an organization would be of great benefit to stock-owners of every section.

In view of the conditions which have surrounded the livestock men of California in the past, and in view of present conditions and future promise, I believe that by effecting such an organization, and by concerted effort, much could be done to advance the livestock interests of this State; to promote the rearing and breeding of a higher class of animals; to prevent the spread of contagious and infectious diseases; to meet the conditions presented by a drought such as we experienced in 1898; to open up and develop foreign markets for breeding-stock and animals for slaughter; and to protect their interests from thieves and wild beasts.

A large portion of the dairy products used by our people are purchased from our sister States, and hogs are shipped to the San Francisco market from the Missouri River country. The grade of stock bred in California is not as high as that in some of the Eastern States, notwithstanding the conditions here are unequaled for the breeding of most excellent animals. The half-bred native sires so frequently used in this State should be replaced by sires of individual excellence.

The scientific feeding of cattle in this State is undeveloped; the economic conditions which prevail in the East have not been adopted by our people; and there is not the proper coöperation between the livestock breeder and the sanitary officer, which experience has shown to be absolutely necessary to eradicate and prevent the spread of the diseases of animals. The good results obtained by the coöperation and organization of the breeders in other States should teach us the wisdom of so doing. I believe that the livestock industry in California would be materially benefited, and the interests of the individual breeder substantially subserved by such a State organization; for, having members and representatives in every part of the State, information as to the existing conditions could be properly received and distributed, and, being an organized body, it would at all times be ready to act for the protection of its members or to further their interests.

FARMING IN SOUTHERN CALIFORNIA.

FURNISHED BY THE "LOS ANGELES DAILY TIMES."

Regarding the soil of Southern California, it may be said that the arable land of the southern counties is found principally in the mountain valleys and coast plains, giving a variety of soil and climatic conditions unusual in a limited territory. The soil ranges in texture from the black alluvium of the swales and peat lands to the light loams of the upland valleys; in thickness from the silt-filled depths of prehistoric gorges to the shallows of the new-made soils of mountain débris; in quality from the cold, sub-irrigated lowlands to the warm, friable ground of the mesas. The climatic conditions incident to change of altitude and the influence of the sea are little less diversified, but always salubrious and healthful, giving the country a versatility of products and advantages to life unsurpassed by any other country in the world. In this range are sections adapted to the tenderest exotics and the hardiest of fruits and flowers. In some specially-favored sections apples of the pine are grown in open air in quality equal to those of the tropics, and the apples of commerce are raised in the elevated valleys, under conditions of the frost and sunshine of their natural habitat. Between these extremes are found soil and climate filling the requirements of almost all the kinds and varieties of grains and fruits cultivated in the civilized world. Warm, alluvial valleys produce citrus fruits by tens of thousands of carloads; coast plains and mountain meadows grow barley, wheat, and hay in tens of millions of tons; cereals, fruits, field vegetables, sugar-beets, and nuts flourish all over the land, and even the rugged cañons give out their lumber, game, gold and honey as their offering to the products of this favored southern land.

WATER CREATES WEALTH.

But with all its versatility of soil and situation it would be a weary waste without the arteries of living water that submerge the fertile soil when the rainfall is withheld, or the land is to be furnished with the elements of a succession of crops in one season. In the development of water and its economic application this section of California has become an example to the arid world. The production of the great variety of fruits and grains to which Southern California is adapted justifies the expenditure of vast sums of money, the use of the highest degree of skill, and the anticipation of steady progress in the establishment of irrigating plants. Public canals, conduits, reservoirs, and distributive pipe-lines have been constructed at an expense of millions of dollars; artesian supplies opened, and underground lakes drawn upon to reinforce the surface waters; farms in thousands ramified with appliances for economic irrigation, all necessary to support the products, built without pattern or precedent, and with unexampled success.

In The Times annual last year much information was published upon the water developments of 1900. This work was distributed throughout the entire fruit-growing territory of the southern counties, resulting in the addition of thousands of inches to the permanent water supplies of the country. During the past year the operations have been less general, but far more extensive. On account of the abundance of surface water, the developments have been confined to territories not under irrigation, and it is within the truth to say that one enterprise put into working order last July has doubled the irrigation supplies of Southern California. This is the chief of the creations of 1901, and reclaims an immense tract near the Mexican line, bringing into immediate cultivation 100,000 acres of fine soil in the Colorado River delta. The reclamation of this fertile tract promises alfalfa for the domestic and Territorial trade, early fruits, vegetables, and sugar-beets in large quantities.

Indio is another section that has made phenomenal progress in the discovery and application of water-supplies during the last year. Here a great artesian belt has been tapped by hundreds of wells, every acre of land within its influence preëmpted and followed by the planting of crops. Last season a large crop of cantaloupes, melons, and other fruits was grown at Indio. The cultivation of cantaloupes began last year, but this spring hundreds of acres will be planted and the fruit ripened before the earliest melons in other States are in the vining stage. The discovery of artesian water at Indio, and the advent of the Imperial Canal have given a great field for the small farmers to bring into productiveness.

Glendora is another town that has made great improvement in its water service during the year, bringing under profitable use a large tract of new lands, and drawing general attention to that locality as a fruit-producing center.

In looking over the field of land reclamation, and the betterment of existing conditions, it will be seen that Southern California has made more rapid progress during the past twelve months than any other portion of the United States, having added to its arable lands a territory large enough for a county, and a flow of water on which it is proposed to float to market the products of the new lands. In every locality improvements have been made in irrigating appliances, giving to the southern counties added supplies and productive force. They may now claim the most expensive and complete irrigation works in the United States.

CEREALS AND HAY.

Southern California is not devoted entirely to the production of fruits, although its fame in this line has largely overshadowed that of other products. Along the coast plains and among the mountain valleys a large acreage is planted every year to wheat, barley, and other grains, and bountiful harvests result in ordinary seasons. Last year a larger area than usual was sown to these cereals, the cultivation of which has become more profitable through the use of improved machinery. While the acreage was larger than that of previous years, wheat fell about 35 per cent short of the average per acre, barley 30 per cent, oats 20 per cent, and corn 40 per cent. With this deficiency the amount of cereals produced in the counties of Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, Orange, and San Diego—counties popularly supposed to be covered exclusively with fruit orchards—is remarkable.

The barley crop of 1901 was 1,375,000 centals, of which about 650,000 centals are stored to supply forage till the new crop comes in. The popularity of barley for stock feed is increasing so rapidly that the demand is already in advance of the supply. Los Angeles dealers are delivering, on contract with the Government, 4,000 tons to Forts Wingate, Grant, Apache, Huachuca, and other stations, and barley-growers find a ready market for their grain as far east as Kansas, Colorado, and Texas. The larger portion of the barley crop is consumed locally, but the exports are heavy, and add materially to the wealth of this country.

One million centals of wheat is the record of last year's crop. The scarcity of cereals in Mexico induced that republic to remove the duties on wheat, the order expiring January 1st. This caused the exportation of 225,000 centals of wheat from Southern California to Mexican points since last summer's harvest. Of the total crop produced last year in the seven southern counties of California, 500,000 centals are on hand. With the exception of the small tonnage of wheat exported to Territorial points, and the shipments to Mexico, the local flour trade will require all this in addition to the 300,000 centals brought by the milling companies from Northern California and Kansas to blend with domestic wheat in the production of certain brands of flour, leaving practically 1,000,000 centals of wheat for home consumption. At the beginning of this year Los Angeles City will have a milling capacity of 1,000 barrels of flour per day. With machinery eight years in advance of that of other Coast mills, this city has about monopolized the home flour trade. The flouring-mills of Los Angeles have been running day and night for two years without stopping, an evidence of the popularity of their flour. It has induced other capitalists to invest in a new mill, with which addition the trade of the southwest can be supplied for some time by our home manufactories.

Southern California is developing a new farm industry—the growing of red oats. This variety is not new, but the demand for it will increase the acreage rapidly at Escondido, Oceanside, the Simi Valley, and at other points, where it has been tried. Over 75,000 sacks of these oats were sent to Texas this season for seed, the other 25,000 sacks being retained for planting in local territory.

About 125,000 centals of corn were grown upon the damp lands and coast plains last season.

One of the largest agricultural industries in Southern California is hay-growing. Over 500,000 tons of wheat, barley, and alfalfa hay were produced in 1901. Of this quantity 60,000 tons are consumed in Los Angeles, 10,000 each at Pasadena, Riverside, San Diego, and their surrounding territories. About half of the total hay output is fed by the producers, and the balance by the townspeople and fruit-growers. For three years previous to June 1, 1901, there were shipped into Southern California from the north, from Arizona, Kansas, and Colorado, about 50,000 tons per year. This season none has been required from outside points.

THE KING OF FRUITS.

The citrus-fruit harvest of the past year reached the splendid proportions of 24,100 carloads, of which 21,173 were oranges, and the balance lemons, tangerines, and grape-fruit. An idea of the advancement of the industry may be gained from the fruit statistics of ten years ago. It is stated that the entire fruit products of California in 1890 were less than 17,000 carloads. In 1900 the citrus products had reached that figure alone. With the last orange crop exceeding by 5,000 carloads the output of fresh citrus and deciduous fruits, cured and canned fruits, raisins and wines of 1890, the progress in the cultivation of oranges may be understood.

In boxes the orange and lemon output for 1901 amounts to 8,724,200, and in pounds to 610,694,000. Ten years ago the citrus-fruit industry was in its experimental stage. The orange had been cultivated for over a hundred years, and produced in marketable quantities for more than a generation. Within the two last decades only had it been recognized as a commercial factor of great importance. Twenty years ago a new variety came into the field, which has since revolutionized fruit-growing, placing this portion of the State under a system of intensive cultivation not equaled in any other fruit-growing section of the world. The varieties of orange introduced by the discoveries of this territory were of a fair quality, prolific, and in every way adapted to the local conditions of the country. But they possess no superior merits over the fruit grown in other countries. Until the advent of the first trans-continental railroad there were no facilities for marketing, and for many years thereafter freight rates were so high, and shipping so slow and unreliable, that little of the fruit found its way into the markets of the East, and there seemed no future for the industry that is now one of the chief supports of California's prosperity.

About the year 1880 the Riverside colony began to send out a few boxes of a seedless orange that had been introduced from Brazil a few years previously. In 1883 the new orange gained universal attention in a contest at New Orleans with oranges from other portions of the world. It captured premiums for superiority after a sharp contest with competing fruit, and was adjudged the finest orange produced.

From that time dates the commercial history of the Washington Navel orange, and the rapid progress of Southern California from a fruit-growing standpoint. Immediately began the real conquest of arid California by those who had faith in the new orange. Riverside became the radiating point for the new orange groves that have since become the most prominent feature of rural life, and which have, in many localities, monopolized the land to the exclusion of most other crops. Within the past few years one or two other varieties have been introduced, which rank well with the Washington Navel in productiveness and quality, but it is to the great seedless orange from Brazil that Southern California must pay tribute for the establishment of a distinctive industry. It has given the State great profit and fame as a fruit-growing center.

In the citrus-fruit achievements of the past the southern counties of the State introduced a new era in horticulture. Never was experimentation in soil, varieties, methods of culture, and modes of marketing made with more enterprise and determination. It brought with it a period of great development, causing the concentration of capital in local investments; the concentration of wealth in supplying the land with water and irrigating facilities; the gathering together of a rural population almost suburban in numbers and advantages of living—of everything pertaining to industrial, social, and educational order; it built towns, invited public improvement in roads, transit lines, hotels, parks, and has done more than any other line of agricultural work to make life in rural California ideal, and its institutions permanent and comprehensive of the future needs of the country.

It has been estimated that every hundred acres of bearing orange trees require the constant services of 150 workmen in growing, harvesting, and packing the products of the orchards. This means a population of at least 500 people, or one inhabitant to every two acres of citrus-fruit groves. To these may be added the artisans, laborers, tradesmen, and professional men that do not come in direct contact with the fruit business, making a population so large that it is drawing millions of dollars in public improvements of every kind, and making life in the country districts enjoyable and profitable to all classes of people.

The progress of the year in citrus-growing localities is remarkable. Tree planting has been active throughout the season. New water developments have opened new lands to the orange and lemon. Nurserymen have found sale for all the plants they could propagate. Roadmakers have been busy constructing better highways, upon which to draw the tens of thousands of carloads of fruits to the shipping stations. New packing-houses have been built, better vehicles procured, and lines of improvement made wherever citrus-fruits are grown. Telegraph and telephone service has been extended to provide facilities for transacting the business of selling oranges and lemons, and other utilities established too numerous to give in detail in this article.

OTHER CITRUS FRUITS.

The notable progress of the past year has not been confined to the orange business. In describing the horticultural developments the lemon must not be overlooked. Hundreds of lemon groves dot the landscape in isolated sections, and large tracts are devoted to this fruit in continuous orchards. By the new process of flat-topped pruning these groves are assuming a novel appearance, always green and refreshing, with a continual round of flower and fruit throughout the year. In every section a satisfactory advance has been made in the methods of curing and packing the fruit. Enlarged company curing-houses, and an increase in individual facilities for preparing and storing lemons, are the new features of progress. Planting has not been as active in this line as it has been with oranges, for the area suitable to lemon-growing is comparatively small, and the territory is pretty well occupied. The future increase of fruit is assured, for there is no limit to the productive capacity of the orchards now in bearing. The superiority of the California lemon has been demonstrated by a dozen analytical tests and by the popular favor it has attained in all the American markets. This fruit is a staple, and will soon be supreme in every trade center in the country. During the shipping season of 1901 nearly 3,000 carloads of lemons went out from the orchards of Southern California, amounting in weight to 40,000 tons.

Some progress has been made in the introduction of Asiatic varieties of citrus fruits. The Tangierine has already become a profitable crop. Other dwarfish kinds, such as the Kumquat, Oonshiu, and citron are grown successfully. Grape-fruit is produced in large quantities, and promises well for the future.

DECIDUOUS FRUITS.

The deciduous-fruit interests of the group of southern counties of California are important. The cultivation of the peach, apricot, prune, and other fruits of this class has proven successful, and it is only a question of superior profits that has caused the other lines of fruits to supersede, in a measure, the deciduous kinds. Southern California has been celebrated since the pioneer days for the beauty, flavor, and abundance of its pears, peaches, and grapes, and had not the soil and situation proved so well adapted to citrus fruits, this section would have maintained its prominence in the production of these fruits.

There is a large number of successful canneries in operation, and Los Angeles has an extensive establishment devoted to preserving and crystallizing fruits. At Ontario a large cannery has just been completed, and the last season witnessed many improvements in the canning facilities all over the South, the season's products being much heavier in all lines of cured and canned fruits than those of the preceding year. Since the beginning of the year there has been much progress made in the destruction of old, abandoned, or neglected deciduous orchards—the bane of every country as its age advances. These will be replaced by better varieties of fruits, the year's experience having pointed out more clearly the profitable varieties in peach, apricot, and other deciduous fruits.

In the Antelope Valley apple culture has received a decided impulse. Reports from that section show a very large area of new apple orchards, and place this portion of the State in a new light as a producer of fine fruits. Apples are grown with success in many of the mountainous portions of the southern counties, and the new year will find many new tracts of land covered with apple orchards. Last month an organization was formed for the purpose of placing the apple industry upon a better basis. It will devote its attention to a general war upon the insect enemies of this fruit, to the introduction of better methods of cultivation, and to the testing of new varieties. Great progress has been made in apple-growing, and within a few years the industry will have become second only to that of the citrus fruits.

The growing of figs, dates, early grapes, apricots, and some varieties of tropical fruits has received a great impulse in the reclamation of the warm, desert sections of Riverside and San Diego counties. Here the climate is so favorable that no section in the United States can vie with it in earliness of production. Experience has shown that dates will flourish in these warm regions, and it is not beyond the probabilities that Southern California and Arizona will soon supply the country with domestic dates. The opening and irrigation of these warm lands are giving early grapes a prominent place. They will ripen two months earlier than in most other portions of the State. The introduction of an insect that fertilizes the fig is one of the greatest achievements of horticultural science. A grower at Fresno has succeeded in producing figs as typical and fine as the Asiatic fig, through the work of this imported insect, and we may now reckon this fruit as one of our staple products.

THE OLIVE.

Olive-growing has been on the decline for several years, owing to the attacks of scale insects and to climatic causes, but great progress has been made in the last year. The present crop of olives is the largest ever grown in Southern California. One orchard at San Fernando is reported to have more fruit than the whole South produced in any previous crop. Renewed interest is noticeable in the cultivation of the olive. The past year has demonstrated that the fruit can be produced in enormous quantities. New capital is investing in the business of oil-making and in preparing for marketing the products of this tree. It is largely in its experimental stage, but this year's experience may solve the problem of what to do with the olive. It grows in great perfection here; the best varieties have been proved, and the most successful methods of cultivation established. While the crop is the most satisfactory in quality, the markets are not well defined, and altogether the cultivation of the olive may be considered yet in the light of uncertain conditions.

GRAPES.

Southern California has made great progress in the cultivation of grapes during the past year. Large tracts in Los Angeles, Orange, and San Bernardino counties have been planted to vineyards since last January, and in no other line of fruits, except the citrus, have the developments been so extensive. Some years ago the vineyards were partially destroyed by a new vine disease. It is yet present in a few sections, but viticulturists do not hesitate to replant. At the present rate of increase this portion of the State in another year will reach its former standing as a producer of wine, table, and raisin grapes.

SMALL FRUITS.

Southern California has made rapid progress in the cultivation of small fruits since the last annual review. The strawberry leads. New territory has been exploited, wells and reservoirs established, and hundreds of acres of strawberries planted during the past year. The finest berries in the world, perhaps, are produced in this territory. Experimentation has shown the varieties adapted to our soils and climate, thus having reached the point of profitable cultivation, and made strawberries a staple as firmly established as citrus fruits. The growing of winter berries has become a great industry.

Other small fruits are also grown abundantly for the fresh fruit markets of the Southwest, and for the local canneries. Blackberry culture has advanced by the introduction of new varieties. The Loganberry is the principal hybrid in cultivation, and many farmers are engaged in its production and profitable marketing, together with raspberries, dewberries, loquats, and guavas. Much progress is observable in the extension of the small-fruit fields of the section, and they add a very large revenue to the resources of the land.

NUTS.

The English walnut is a commodity with which the world never seems to be surfeited, but a few of the southern counties are doing all they can to supply the demand. There is a steady increase in the area planted, the progress of the year being marked in the extension of this industry, where the soil is suitable for the cultivation of the nut. Last season the walnut crop of Southern California amounted to about 600 carloads, a fungous disease having reduced the yield to some extent in a few of the leading districts. Rivera, Downey, Santa Ana, Fullerton, Ventura County, and a few points in San Diego and Santa Barbara, are the walnut-growing centers of the country, Rivera and other points in the Los Nietos Valley producing nearly half of all the nuts shipped from the southern territory.

Pecans grow well in many portions of the State. We may never look for a pecan-growing craze such as is now raging in Georgia and Alabama. However, it is a nut that should receive more attention. Experiments are being made in its cultivation in several localities.

Orange County is celebrated for the extent and quality of its peanut crop. This nut—which is not a true nut—grows to perfection, and rivals its southern competitors in yield and excellence. New territory is being devoted to this prolific and profitable plant, and its growth forms an important item in the products of the land where the conditions are favorable.

The area devoted to almond-growing has decreased somewhat during the past year. This is chargeable to the tenderness of the bloom. The almond does not flourish where insect smuts and other fungi prevail, but the mountainous districts and uplands supply the conditions for producing the finest almonds grown. Portions of the Antelope Valley tablelands are peculiarly adapted to this fruit, last year's crop proving satisfactory wherever frost did not prevail. In many of the coast localities the almond orchards are disappearing entirely—another evidence that horticultural progress is abroad and engaged in weeding out the unprofitable, and substituting kinds that will pay. There is a great future for the almond in the warm upland districts, and it has been very well established in regions suitable to its profitable cultivation.

Black walnuts and filberts are grown, but are of very little commercial importance. There are a few acres of chestnuts, but this nut is not raised on a commercial scale.

VEGETABLES.

Fields of waving celery, tracts of growing beans, acres of onions, asparagus, cantaloupes, melons, squashes, and pumpkins give a varied and attractive appearance to the lands of this section, and a diversified aspect to the landscape, that not only add beauty to the scene, but interest from a financial standpoint. Whether fruits or flowers, vegetables, nuts, or unclassified exotics, there is a novelty of some kind in every landscape throughout this favored land. The difference is not only in appearance, but it prevails in soil characteristics and situation. The celery fields of Westminster are so swampy that the workmen and their teams are provided with broad boards upon their feet to enable them to walk over the soft ground—the most fertile soil ever placed under cultivation. In the dry lands, where winter vegetables are grown, irrigation is necessary even in the rainy season, and the ground is firm and close, under all conditions. There are extremes in every element that bear upon the production of vegetables, from the cold, watery, peat lands to the warm, dry soils upon which peas, tomatoes, and green corn are produced almost every month of the year. This versatility of climate and soil makes Southern California a famous depot for vegetables, and great are the interests that have grown up under these favorable conditions.

Winter vegetables are shipped East and sold at profitable figures, along with the hot-house products of the cities. Celery leads in importance. It is estimated that nearly 1,500 carloads of celery are raised in this locality every season, Orange County producing almost all that is grown. Cabbage and cauliflower are raised in field quantities, something over 1,000 carloads each season being the usual output. Potatoes are grown over large areas, this season proving unusually profitable for that line of agricultural crops. The varied advantages of Southern California in soil and location are applicable to the growth of vegetables as well as fruits, and the last year has witnessed a marked advancement in their cultivation, and a better understanding of the adaptability of each to the locations at hand.

The express companies have established daily refrigerator service from Los Angeles to Chicago for the sole purpose of putting asparagus, green peas, and artichokes into the market in a condition as perfect as possible. The first train left Los Angeles on Monday, March 24th, and arrived in Chicago, on Thursday, March 27th, a four days' run. Other early California vegetables will have the same service as they come into season. Green peas are in especial demand. Illustrating this, 165 crates were sold in Chicago for $1.25 per case of four baskets.

Ventura County raises the beans of the Pacific Coast, although Orange County is developing the bean industry at a fair rate, 20,000 sacks being the output of Orange County last season. Along the coast, from Simi Valley to Santa Barbara, lies the greatest bean-growing country on the continent. The lima variety of this locality is the high-priced product of the bean fields, selling for 5 cents a pound, or 50 per cent higher than most other varieties. Thousands of acres are devoted to this crop in Ventura and Santa Barbara counties, and the only element that seems likely to reduce the acreage is the cultivation of sugar-beets. The bean crop is one of the greatest of California's special products.

LIVESTOCK.

The industrial condition of the ranges and stock farms has improved rapidly during the past twelve months. For several years the breeding of horses was neglected in this part of the State, sharing in the general depression of that industry all over the country. Within the year prices have advanced, and the interest in good stock has been stimulated in consequence. Good roadsters, farm horses, and heavy teams are in demand at prices that insure a continued revival of the trade. Not only is the interest felt in work horses, but the organization of driving clubs and the development of local speeders have brought renewed attention to the ring. Horsemen predict higher prices for better grades of stock, and we may expect a bright future for first-class horses as the highways are improved and the people become acquainted with the superior advantages of Southern California as a location for the breeding of good horses.

The prospects of the cattle range have improved remarkably, perhaps faster during 1901 than any other branch of land industries. The herds have increased by purchase from other sections, and the pasturage of the young stock heretofore slaughtered. The business has been so prosperous that large cattle companies are forming, and several are already in the field with capital sufficient to bring cattle-raising to its former significance within the next year or so. The health of grazing stock is perfect, and with the opening of large alfalfa tracts, and the better cultivation of the farms, both grazing and cattle farming are in a satisfactory condition.

The dairy interests of this section are prospering. Better methods of feeding, improved appliances for making butter and cheese, the establishment of convenient creameries, selection of better stock, and advancement in marketing experience, have restored the dairy business, and even advanced it during the past year. We hear little about the importation of dairy products since the creameries and cheese factories have been supplied with the material from which to manufacture them. The dairy interests of this portion of the State are increasing in importance, and will soon supply the local trade.

Of the minor stock industries a revival of swine-raising is of the most importance. Better breeds are being introduced, and the question of feeding is studied with a view of improving the quality of the meat. The sheep flocks are in fine condition, and while their owners are opposed more or less by the farmers and fruit-growers, there are sections where no opposition exists. The production of wool has been generally profitable, leading to a renewed interest in the breeding of sheep and goats of a higher grade, and promising further advancement as the country develops.

POULTRY.

The beginning of 1902 finds Southern California less dependent upon Eastern poultry supplies than it has been since the pioneer days. A few years ago the country depended upon importations of fowl and eggs. Fruit-growing, as it is, is not conducive to chicken-raising, and for many years the demand came faster than the supplies. As the industries developed, however, it was found profitable to engage more extensively in the production of chickens to supply the needs of the growing cities and towns, and of the ranchers who could not spare the time to supply their homes—an easy matter under ordinary farming conditions.

Within the past decade great advancement has been made in this line. Through the introduction of thoroughbred stock, the holding of poultry shows, and the advent of many who did not expect to become fruit farmers, the raising of chickens and other fowl has become popular wherever the surroundings are suitable. In many cases capital has been put into the business, making it possible to supply the trade in large quantities, and in a great measure making this end of the State self-sustaining.

Few countries have better climatic conditions for poultry-raising, or less disease to contend with in the production of fine fowl. Housing is less expensive than in other States, and winter feeding is less laborious and more profitable. With so many tourists, and city and country customers to supply, and the adaptation of this section to the business, poultry-raising will increase and become an important industry measured with some of the greater enterprises of this portion of the State. There is also great interest developing in pet stock, a greater determination to preserve the wild game of the unsettled districts, and an effort to introduce better poultry and farm stock in every line.

THE APIARY.

The amount of honey produced in 1900 in the territory south of the Tehachapi was about 200 carloads. Bee-raising is again attracting general attention. Apiarists have found great difficulties in procuring bee colonies, the prices for stands having advanced to old-time figures, on account of the scarcity following the dry seasons. The reputation of Southern California honey is unsurpassed, the products of this portion of the Coast setting the price for the honey of the United States. With the prosperous conditions promised for the future, bee-raising is likely to become one of the most important of the minor industries of Southern California.

BIG BIRDS.

The ostrich farm at South Pasadena is one of the popular sights of Southern California. It is not merely run as a show, but also as a profitable business enterprise, large quantities of feathers and articles manufactured from feathers being sold and shipped to all parts of the United States. There were formerly several ostrich farms in Southern California, but this is now the only one, although there are a few birds on exhibition at Coronado. There are at present about 135 birds on the farm. They are found to thrive as well in Southern California as in their native country.

There were recently imported seventeen Nubian birds, which are supposed to have the finest plumage of any of the African ostriches. They run wild, and the only way to get them is by bartering with the natives, and then only chicks can be obtained, as the old ones escape.

The proprietor of this establishment recently opened a new ostrich farm, between Nice and Monte Carlo, in the south of France, so that Southern California may now claim, among its varied industries, the exporting of ostriches to Europe.

OUTPUT OF PRINCIPAL PRODUCTS.

The following table, showing the estimated value of leading products of Southern California in 1901, has been compiled by the Los Angeles Chamber of Commerce:

Citrus fruits	$10,000,000
Gold and silver	6,300,000
Petroleum—estimates	5,600,000
Borax	1,214,000
Hay	3,000,000
Vegetables and fruit consumed	2,000,000
Dried fruits and raisins	2,000,000
Grain	3,000,000
Canned goods	1,500,000
Sugar	3,350,000
Fertilizers	360,000
Nuts	1,155,000
Cement, clay, and brick	350,000
Wine	330,000
Beer	650,000
Butter	675,000
Beans	3,500,000
Asphaltum	501,000
Eggs	500,000
Celery	225,000
Poultry	300,000
Hides	150,000
Fresh fish	275,000
Canned fish	105,000
Wool	150,000
Vegetables—exported	340,000
Cheese	150,000
Olives and olive oil	425,000
Salt, mineral water, and lead	457,000
Honey	275,000
Lime	102,000
Hogs, cattle, etc.	2,327,000
Miscellaneous manufactured productions	20,000,000
	$71,266,000

VITICULTURE.

The vintage of 1901 was very satisfactory to both the vintager and the vintner. Crops having been light for the past four years, being affected by frosts and disease, the prices of grapes, both wine and table, rose to a phenomenal figure. These conditions existed all over the State.

In Sacramento County, the production of wines was about 17,250,000 gallons; of brandies, 1,250,210 gallons; the varieties of wines produced being principally port, sherry, angelica, muscat, and tokay, besides some very good grades of claret. Indeed, it is really surprising to see what a fine grade of claret is now being produced in Sacramento County, the general impression having prevailed that grapes grown in the interior counties were not capable of producing a high-grade claret. This is a fallacy, as the results of the last two vintages have proven. The ports and sherries have been particularly fine, and we may speak of Sacramento County as the banner county for the production of sherry. There is probably no other section in the State that produces as fine a quality of sherry wine as does Sacramento County.

Adverting to the prices of grapes. It would seem impossible for the wineries to pay the large sums that prevailed the last two years, and still make a profit. The prices of wines do not advance in proportion to the advance in the prices of grapes. There is a limit to what wines can sell for. That limit is guarded by a certain tariff law, which, if the prices of California wines go up too high, allows the foreign wines to enter and take the local markets.

Fortunately, the season of 1902 augurs well for a very full crop of grapes throughout the entire State. This will tend to equalize the prices of grapes, and we may look for a lower rate per ton to prevail this season; still, the prices ought to be highly satisfactory to the grower.

The season of 1902 has seen the planting of a great many acres to new vines. The phylloxera is gradually but surely extending its ravages, and resistant stock is being planted, which is the only safeguard against the destruction of vineyards by the worst disease with which the grower has to contend. The Rupestris St. George seems to be the most popular of all resistants yet found, so far as the records show. In France it has been used successfully for the past fifteen years. It is the consensus of opinion that the Rupestris St. George is about the best variety to plant in general soils.

THE BEET-SUGAR INDUSTRY.

For the benefit of those who may be interested in learning a few facts relative to this new and very important industry, as it stands at the beginning of 1902, the State Agricultural Society submits the following, which has been compiled with care and may be accepted as correct, except as to the figures bearing on the production for 1901, some of which are not yet obtainable, and are, therefore, approximate.

A brief review of the industry is desirable, however, for the purpose of affording a comparison with the business for 1901; and particularly as illustrating the very conspicuous position occupied by California in the efforts of the country at large to produce the sugar consumed by our people.

Prior to 1888 but very feeble efforts had been made in the production of beet sugar in the United States, although in 1838–9 beet sugar of "good quality" was made in the valley of the Connecticut, and was awarded a silver medal by the Massachusetts Charitable Mechanics Association.

In 1863–4 a beet-sugar factory was established at Chatsworth, Illinois, but it proved a losing venture, for two material reasons, apparently; the first being from lack of sufficient capital, and the second from the very low sugar content of the beets, which at that day was far less than at the present time, when, as a result of our magnificent conditions in California for raising sugar-beets, we have also succeeded in raising a sugar-beet seed which rivals the best efforts of seed-growers of Europe, in the high polarization or sugar content of the beets grown therefrom.

The first effort in the United States in a large commercial way to manufacture sugar from the beet root stands to the credit of California, and dates from 1887–8, when Claus Spreckels, with his incomparable sagacity on the general topic of sugar production, and unbounded confidence in the future of the industry in our country, built a beet-sugar factory at Watsonville, Santa Cruz County, of a capacity for working 1,200 tons of beets daily, the operations of which have become so generally known through the channels of the public press that it has for years been pointed to as an all-sufficient argument for those seeking new fields for the investment of capital.

With this undertaking began a new era for the farmer, the consumer, and the manufacturer as well. From a crop of uncertain value due to fluctuations on the boards of trade, or 'change, which often reduced the net results to the farmer to a disastrous figure, he turned to a crop—backed up by a specific contract as to price—which, with intelligent industry, at once paid a large profit, and saved many a farm from going under the hammer.

The consumer—the capricious public—at once felt the beating of the pulse of this infant Goliah, in the lowering of prices (more pounds of sugar for a dollar), and which has steadily fought its way to public favor, until to-day at any grocery store twenty-two pounds of granulated sugar can be obtained for one dollar.

The manufacturer, he who with anchored faith and indomitable pluck, courage, and that patient perseverance which always attends the man of genius, kept steadily at his work—that of establishing in this State an independent source of its sugar supply which for all time would place it in the *front* rank as a sugar-producing State among the States of this Union.

And what is the result? From an annual output of 1,452 tons of sugar in 1888, the Watsonville factory increased its output steadily each year, as farmers learned how to raise beets profitably, until in 1896 over 19,000 tons were made. It has resulted not only in his building a beet-sugar factory near Salinas of a daily capacity of 3,000 tons of beets, the largest in the whole world, but in the building or remodeling and enlarging of six other factories in this State having a combined tonnage of 6,200 tons of beets daily.

It will be noted at once that the two factories operated by the Messrs. Spreckels, namely, that at Spreckels, Cal., with a daily capacity of 3,000 tons of beets, and that at Watsonville, with a daily capacity of 1,200 tons of beets, represent over 40 per cent of a total capacity for the State, amounting to 10,400 tons daily; which is borne out further by the following figures, showing approximately the granulated sugar output of the California beet-sugar factories for the campaign of 1901, just closed:

Spreckels Sugar Company	27,000 tons,	or 41	per cent.
Alameda Sugar Company	7,500 "	" 12	"
Union Sugar Company	3,000 "	" 4	"
American Beet Sugar Company	18,000 "	" 27	"
California and Hawaiian Sugar Refining Company	5,000 "	" 7	"
Los Alamitos Beet Sugar Company	6,000 "	" 9	"
Total	66,500 tons.		

The average daily capacity for working beets in the factories of California, aside from those owned by the Spreckels Sugar Company, is cut down to 1,033 tons, of which three factories, with an average daily capacity of 1,233 tons, are south of the Tehachapi, and three, with an average daily capacity of 833 tons, are north of that divisional line, which is generally quoted as the boundary between Northern and Southern California efforts.

There are at the present time forty-one completed factories in the United States, classified as follows:

	Factories.	Average Daily Capacity.
Eastern States	2	600 tons.
Middle States	16	512 "
Western States	12	487 "
Pacific States	10	1,090 "
Territories	1	200 "

AGRICULTURE IN CALIFORNIA.

COMPILED FROM U. S. CENSUS BULLETIN, APRIL 29, 1902.

California, the second largest State in the Union, has a total land area of 155,980 square miles, or 99,827,200 acres, of which 28,828,951 acres, or 28.9 per cent, are included in farms.

The northern part of the State is rugged and mountainous, but contains some fertile valleys of small size. From this region two mountain ranges extend southward, one along the coast and the other along the eastern boundary. Between these two ranges lie the Sacramento and San Joaquin valleys, comprising the largest body of farming land in the State. In the south the surface becomes more even, the coast mountains almost disappearing.

The soil of the northern valleys is very rich, but the mountains are generally wooded, and suitable only for grazing purposes. The soils of the Sacramento and San Joaquin valleys vary from a sandy loam to a heavy clay, and are everywhere fertile. The southern part of the State is generally arid, but under an extensive system of irrigation the land has become exceedingly productive and valuable.

The diversity in the soil and in the climate of California renders possible a greater variety of agricultural products than is found in any other State of the Union.

Most of the farms reported in 1850 were cattle ranches operated by Mexicans under Spanish land grants. The discovery of gold in 1849, and the subsequent rapid immigration, resulted in abnormally high prices for farm produce and in a marked development of agriculture. The great increase in the area of improved farm land in the decade from 1850 to 1860 marks the real beginning of agriculture in California.

Since 1860 the number of farms has increased steadily, the rate of gain the last decade being 37.1 per cent. The total area in farms also increased rapidly, from entry on the public domain and purchase or lease of railway subsidy lands. The increase in the area of improved farm land has kept pace with the general advancement, although on account of the adoption by recent censuses of a stricter definition of the term "improved land," and the conversion of agricultural land into cattle ranches, a decrease is shown for the last decade. The average size of farms has decreased as intensive cultivation has become more general, and as special branches of agriculture have been developed.

The total value of farm property increased very rapidly until 1890, but for the succeeding decade a gain of only 3.2 per cent is shown. This small increase is doubtless due in part to the financial disturbances in 1893, and the subsequent period of depression, as the very substantial gain made in the value of farm products furnishes conclusive evidence that the agricultural interests of the State are not declining. The value of land, improvements, and buildings increased 1.5 per cent from 1890 to 1900. The value of implements and machinery increased 45.1 per cent and that of farm products 51.3 per cent, a portion of each increase being, doubtless, the result of a more detailed enumeration in 1900 than heretofore. In the same period the value of livestock increased 11.7 per cent.

During the past decade the number of farms increased rapidly in nearly all counties. In San Francisco and Tuolumne counties the number of farms reported in 1900 was more than double that of ten years before, and in Inyo, Siskiyou, and Los Angeles counties the gains were nearly as great. Seven counties show decreases, but, with the exception of Colusa and Amador, whose losses are 43.4 and 20.0 per cent, respectively, they were all comparatively slight. The decrease in Colusa County was doubtless due to a change in boundary since 1890.

The total area of farm land in the State is 34.5 per cent greater than in 1890. In Tuolumne, San Francisco, Mono, Orange, Kern, and Inyo counties the farm area more than doubled. Of the decreases shown, the largest were for Colusa and San Bernardino counties.

The percentage of farm land improved was less than it was in 1890 in all counties except in those showing marked increases in total farm acreage, and in a few counties around the cities of San Francisco and Los Angeles. A comparison with the figures for 1890 shows a gain in the total acreage devoted to crops in nearly all counties, even in those showing the greatest decreases in improved land.

A lower value of land and buildings than in 1890 is reported for all counties except Los Angeles, Ventura, and Santa Barbara in the southwest; San Joaquin, Calaveras, and most of the counties bordering upon San Francisco Bay, in the central part; and Sierra, Plumas, Lassen, Modoc, and Siskiyou counties in the northeast. These counties are, as a rule, adapted to the growing of fruits and vegetables, while the other parts of the State are devoted, in general, to hay and forage and to livestock raising.

The value of implements and machinery has increased since 1890 in every county except Colusa, Butte, Amador, and Yuba, which show decreases of 43.7, 18.5, 14.8, and 10.7 per cent, respectively. The largest relative gains are in those counties where fruit-raising and dairying are the leading branches of agriculture.

The total value of livestock has increased 11.7 per cent, the largest relative increase being in Tuolumne County. The general agricultural progress of this county in the past ten years, which has been very marked, is probably due to its large relative increase in population.

The average expended per farm for labor was $356 for the State, and ranged from $67 in Mariposa County to $1,051 in Colusa County. In the latter county $1.11 was expended for every acre of farm land. The average was highest in San Francisco County, where it amounted to $30.30 per acre.

The amount expended for fertilizers in 1900 was more than six times as great as it was ten years before. Large increases were shown for all counties except San Francisco and Shasta. As a rule, the counties reporting the largest acreages in fruits reported also the highest average expenditures for both labor and fertilizers.

From 1850 to 1900 the population of California increased from 92,597 to 1,485,053, or sixteenfold, while the number of farms increased from

872 to 72,542, or over eightyfold. In other words, from 1850 to 1900 the number of farms, and hence the number of persons operating them as owners or tenants, increased faster than the population. This statement applies also to the decades, 1850 to 1860, 1870 to 1880, and 1890 to 1900.

Data showing, with any exactness, the relative increases in the various classes of the farm population are available for only a portion of the fifty years covered by the foregoing comparisons. That portion is the period from 1870 to 1890, during which time the number of farms, and hence of farm owners and tenants, increased approximately 123.0 per cent, while the total State population increased but 115.6 per cent. During the same period the number of males engaged in agriculture increased from 47,580 to 126,711, a gain of 166.3 per cent, which represents approximately the rate of increase in the total number of persons living on farms; and the number of males working for wages on farms increased from 16,156 to 51,532, or 219.0 per cent. These figures show that, in the period mentioned, California was one of the few states that added more to its agricultural than to its other population. Of the different classes of farming population the gain was largest among those working for wages, although the numbers of farm owners and tenants increased faster than the total population. This increase in the number of those working for wages in California was incidental to the introduction of more intensive methods of cultivation, and to the development of such special branches of agriculture as fruit-growing, in which California now leads. The beginnings of these changes were made by the owners of the large ranches into which the entire farming area of California was originally divided.

In the last decade the number of farms, and hence, of owners and tenants, increased 37.1 per cent, while the total rural population increased but 12.7 per cent. This indicates that in the last ten years, unlike the two decades preceding, the number of persons operating farms as owners or tenants increased faster than the number of those who worked for wages. The more intensive cultivation of the soil and the growing of fruit, which were introduced between 1870 and 1890 by large capitalists who employed many hired laborers, seem now to be passing to a considerable extent into the hands of smaller farmers, who, as owners or tenants, manage and cultivate their lands in person.

LIVESTOCK.

The total value of all livestock on farms and ranges, June 1, 1900, was $67,242,112. Of this amount the value of horses constituted 26.5 per cent; dairy cows, 16.0 per cent; other neat cattle, 32.6 per cent; sheep, 10.4 per cent; mules and asses, 7.1 per cent; swine, 3.7 per cent; poultry, 2.8 per cent; and all other livestock, 0.9 per cent.

No reports were received of the value of animals not on farms, but it is probable that such animals have higher average values than those on farms. Allowing the same averages, however, the total value of all livestock in the State, exclusive of poultry and bees not on farms, is approximately $72,827,000.

Number of Domestic Animals, Fowls, and Bees on Farms, June 1, 1900, with Total and Average Values, and Number of Domestic Animals Not on Farms.

Livestock.	Age, in years.	On Farms.			Not on Farms.
		Number.	Value.	Average Value.	Number.
Calves	Under 1	329,430	$2,796,201	$8 49	4,478
Steers	1 and under 2	134,962	2,296,430	17 02	793
Steers	2 and under 3	109,183	2,722,506	24 94	991
Steers	3 and over	86,340	2,796,313	32 39	5,994
Bulls	1 and over	24,725	845,470	34 19	476
Heifers	1 and under 2	148,289	2,696,263	18 18	1,367
Cows kept for milk	2 and over	307,245	10,739,070	34 95	19,511
Cows and heifers not kept for milk	2 and over	304,450	7,762,893	25 50	984
Colts	Under 1	23,049	423,427	18 37	724
Horses	1 and under 2	24,639	763,613	30 99	627
Horses	2 and over	373,605	16,657,953	44 59	92,820
Mule colts	Under 1	5,035	104,787	20 81	63
Mules	1 and under 2	6,469	247,975	38 33	84
Mules	2 and over	73,269	4,258,147	58 12	3,332
Asses and burros	All ages	2,227	146,697	65 87	560
Lambs	Under 1	838,385	1,579,388	1 88	4,515
Sheep (ewes)	1 and over	1,335,390	4,046,633	3 03	10,713
Sheep (rams and wethers)	1 and over	389,578	1,377,210	3 54	3,003
Swine	All ages	598,336	2,476,781	4 14	24,029
Goats	All ages	109,021	262,981	2 41	3,606
Fowls:*					
Chickens†		3,947,200	1,877,489		
Turkeys		158,356			
Geese		28,419			
Ducks		62,293			
Bees (swarms of)		129,444	363,885	2 81	
Value of all livestock			$67,242,112		

* The number reported is of fowls over 3 months old. The value is of all, old and young.
† Including Guinea fowls.

DAIRY PRODUCE.

With respect to the number of farmers engaged in its pursuit, dairying holds fourth place among the various branches of California agriculture. Of the 72,542 farms of the State in 1900, 8,686, or 12.0 per cent, were dairy farms. The increase in the production of milk during the last decade was 42,493,555 gallons, or 38.2 per cent, although the population of the State increased but 22.7 per cent. The average production per capita for the State increased from 92.0 gallons in 1889 to 103.5 gallons in 1899. In Yolo, Calaveras, Trinity, and Stanislaus counties the gains were especially marked, the production in 1899 being between two and three times as great as that reported for 1889. Since 1880 the quantity of milk sold has increased 44,187,768 gallons, or over fourfold. These gains all support the conclusion that dairymen are not only keeping better cows, but devoting more care to their herds than they did ten years ago.

A comparison with the figures for 1890 shows a decrease of 22.1 per cent in the quantity of butter, and an increase of 9.8 per cent in the quantity of cheese, made on farms. In 1900 butter was reported by 32,088 farmers, who produced an average of 650 pounds per farm; cheese was reported by 420 farmers, but the average production per farm was 10,118 pounds.

Of the $12,128,471 given as the value of all dairy produce in 1899, $2,956,217, or 24.4 per cent, represents the value of dairy produce consumed on farms, and $9,172,254, or 75.6 per cent, the amount realized from sales. Of the latter amount, $5,847,591 was derived from the sale of 56,540,946 gallons of milk; $2,903,714, from 15,236,667 pounds of butter; $364,456, from 3,989,893 pounds of cheese; and $56,493, from 71,305 gallons of cream.

POULTRY AND EGGS.

The total value of the products of the poultry industry in 1899 was $6,356,746, of which amount 39.2 per cent represents the value of fowls raised and 60.8 per cent that of eggs produced. Nearly eleven million dozen more eggs were produced in 1899 than in 1889, the per cent of increase being 78.7.

WOOL.

The production of wool has decreased steadily since 1879. In the last decade the decrease was 2,678,052 pounds, or 16.4 per cent. The average weight per fleece, however, remaining practically the same, having been 4.8 pounds in 1889 and 4.7 pounds in 1899. Lake, Tehama, and Shasta counties reported nearly one half of the total number of fleeces of mohair and goat hair.

HONEY AND WAX.

The quantity of honey produced is 1899 was 3,667,738 pounds, a decrease of 262,151 pounds, or 6.7 per cent, from the production in 1889. The production in wax increased 91.5 per cent. The largest decreases in the production of honey were in the southernmost counties, where severe droughts injured the alfalfa and other food plants of the bee. There were marked increases in Fresno, Kern, and Tulare counties.

CEREALS.

In 1899 the total area devoted to cereals was 3,984,036 acres; in 1889 it was 3,812,751 acres; and in 1879, 2,561,800 acres. In the decade from 1889 to 1899, the acreage in oats increased 167.0 per cent; rye, 129.5 per cent; and barley, 26.2 per cent. Buckwheat shows a decrease of 40.5 per cent; corn, 23.3 per cent; and wheat, 5.5 per cent. Although the production of buckwheat, corn, and wheat decreased during the last decade, there was an increase of approximately 5 per cent in the total production of cereals. The largest acreages and quantities, and the largest average yields per acre are found along the San Joaquin and Sacramento rivers. San Joaquin County reports more barley, rye, and wheat than any other county; Sutter County, more buckwheat; and Sonoma County, more corn and oats. Nearly 85 per cent of the 420,452 bushels of Kafir corn reported, was grown in the south central counties of Fresno, Kings, Kern, and Tulare. The acreage given for cereals is exclusive of the acreage of grains cut green for hay and of the acreages of corn, non-saccharine sorghum, and similar crops grown for forage and ensilage.

HAY AND FORAGE.

In 1900, 49,402 farmers, or 68.1 per cent of the total number, reported hay and forage crops. Excluding cornstalks and corn strippings, the average yield obtained was 1.4 tons per acre. The acreage in hay and forage in 1899 was 56.4 per cent greater than ten years before. In 1899 the acreages and yields of the various kinds of hay and forage crops were as follows: Wild, salt, or prairie grasses, 223,854 acres and 176,466 tons; millet and Hungarian grasses, 1,741 acres and 3,567 tons; alfalfa, or lucern, 298,898 acres and 838,730 tons; clover, 12,407 acres and 22,638 tons; other tame and cultivated grasses, 153,646 acres and 195,627 tons; grains cut green for hay, 1,506,360 acres and 1,714,692 tons; forage crops, 42,695 acres and 83,546 tons; cornstalks and corn strippings, 459 acres and 716 tons.

HOPS.

The cultivation of hops in California is rapidly becoming an important industry, the quantities reported for each census year since 1860 being as follows: 1860, 80 pounds; 1870, 625,064 pounds; 1880, 1,444,077 pounds; and in 1890, 6,547,338 pounds. In 1900, 203 farmers reported an area of 6,891 acres, or an average of 33.9 acres per farm. They obtained and sold from this land in 1899, 10,124,660 pounds of hops, an average of 1,469 pounds per acre, and received therefrom $925,319, or an average of $4,558 per farm, $134 per acre, and $0.09 per pound.

The counties producing hops are mostly inland and extend from the extreme north over two thirds the length of the State, Sonoma, Mendocino, and Sacramento counties reporting 62.0 per cent of the total acreage.

ORCHARD FRUITS.

The changes in orchard fruits since 1890 are shown in the following table:

Orchard Trees and Fruits—1890 and 1900.

Fruits.	Number of Trees.		Bushels of Fruit.	
	1900.	1890.	1899.	1889.
Apples	2,878,169	1,269,784	3,488,208	1,654,636
Apricots	4,244,384	1,442,749	2,547,064	970,941
Cherries	686,891	236,945	321,034	154,063
Peaches	7,472,393	2,669,843	8,563,427	1,691,019
Pears	2,512,890	695,738	1,912,825	577,444
Plums and prunes	9,823,713	1,509,833	5,632,036	1,202,573

Of the farmers of the State, 27,491, or 37.9 per cent, reported orchard fruits in 1899. The value of orchard products was not reported by the census of 1890; but in 1879 it was $2,017,314, and in 1899, $14,526,786, a sixfold gain in twenty years. In making comparisons between the crops of different years, however, it should be remembered that the quantity of fruit produced in any year is determined largely by the nature of the season.

The number of orchard trees increased in the last decade from 7,824,892 to 28,138,471. The most noteworthy changes were in plum and peach trees, which increased about sixfold and threefold, respectively. In 1890, 34.1 per cent of all fruit trees in the State were peach trees, and 19.3 per cent plum and prune trees, while in 1900 the corresponding percentages were 26.6 and 34.9.

Plum and prune trees are found in the greatest numbers in the west central part of the State, more than one third being in Santa Clara County. These trees increased so rapidly in the last decade that their number in 1900 was greater than the total number of orchard trees in 1890. Tuolumne is the only county in which the number of plum and prune trees has not increased since 1890.

The leading peach-growing counties are Fresno, Placer, Santa Clara, Tulare, Tehama, and Los Angeles; in 1900 they reported more than one half of all the trees. Most counties reported a much greater number in 1900 than in 1890.

In the last ten years the number of apricot trees has more than doubled. Over one third of these trees are in Santa Clara, Ventura, and Los Angeles counties.

Apple trees increased in number 126.7 per cent between 1890 and 1900. The coast counties report the largest numbers—Santa Cruz, Sonoma, Monterey, Los Angeles, Mendocino, and San Diego counties having more than one half of the total number in the State.

The adjoining counties of Solano and Sacramento contain one fifth of the pear trees in the State. Nearly three times as many were reported in 1900 as in 1890. Cherry trees, also, show a large increase, but are relatively of small importance.

In addition to the trees shown in the table above, unclassified fruit trees to the number of 520,031 were reported, with a yield of 228,176 bushels of fruit.

SEMI-TROPICAL FRUITS.

The following table shows the changes in semi-tropical fruits since 1890:

SEMI-TROPICAL TREES AND FRUITS—1890 AND 1900.

Fruits.	Number of Trees.		Quantities of Fruit.		
	1900.	1890.	Unit of Measure.	1899.	1889.
Citrons	4,780	1,757	Boxes	90	------------
Figs	188,941	109,535	Pounds	10,620,366	11,190,816
Guavas	7,056	11,495	Pounds	31,370	------------
Kaki	2,690	19,101	Pounds	59,400	------------
Lemons	1,493,113	82,611	Boxes	874,305	305,598
Limes	311	2,007	Boxes	125	------------
Oranges	5,648,714	1,153,881	Boxes	5,882,193	1,245,047
Pineapples	*1,815	*145,000	Number	440	------------
Pomeloes	80,918	144	Boxes	17,851	------------
Olives	1,530,164	278,380	Pounds	5,040,227	9,659,208
Miscellaneous	37,957	†5,250	Pounds	317,330	------------

* Number of plants. † Banana trees.

The total number of semi-tropical fruit trees increased from 1,809,161 in 1890 to 8,996,459 in 1900. Of the number reported in 1900, 62.8

per cent were orange trees; 17.0 per cent, olive trees; 16.6 per cent, lemon trees; 2.1 per cent, fig trees; and 1.5 per cent, other trees.

The orange groves were reported chiefly by southern counties—San Bernardino, Los Angeles, Riverside, and Orange counties containing more than four fifths of the trees. In 1900 the number reported was nearly five times as great as it was in 1890. All counties reporting oranges shared in the increase, except Lake and Santa Barbara. The production showed a still greater gain.

Olives are grown chiefly in the extreme southern counties—Los Angeles, San Diego, Ventura, Riverside, and San Bernardino furnishing the greater part of the crop of 1900. The number of olive trees reported in 1900 was nearly six times that reported in 1890. Excluding Los Angeles, the counties named showed a hundredfold increase.

San Diego and Los Angeles counties report over one half of the lemon trees of the State, and show marked increases since 1890, the number reported in 1900 being over eighteen times as great as ten years before.

The fig-growing industry centers in Fresno County. Pomeloes, or grape-fruit, which in 1890 were reported in but four counties, are now grown in over one half of the counties of the State. Pineapples are found chiefly in San Diego and Riverside counties, and citrons are confined almost exclusively to Los Angeles County. The remaining fruits are of small and decreasing importance.

SMALL FRUITS.

The total area used in the cultivation of small fruits in 1899 was 6,353 acres, distributed among 5,137 farms. The value of the fruits grown was $911,411, an average of $177.42 per farm. Of the total area, 2,418 acres, or 38.1 per cent, were devoted to strawberries; the total production for the State was 7,690,830 quarts, of which more than one third was reported by Santa Cruz County. Next in importance are blackberries, of which 1,960 acres were reported. Sonoma County reported one fourth of the total production of 4,159,131 quarts.

The acreage and production of other berries were as follows: Raspberries and Logan berries, 1,039 acres and 1,446,190 quarts; currants, 729 acres and 1,031,100 quarts; gooseberries, 135 acres and 195,670 quarts; and other small fruits, 72 acres and 59,030 quarts.

GRAPES.

Grapes were grown in 1899 by 13,064 farmers, who obtained 7,214,334 centals of fruit from 90,686,458 vines. The total value of the grapes, including the value of raisins and of 5,492,216 gallons of wine made on farms, was $5,622,825. Of the quantity of grapes reported, raisin grapes contributed 3,403,368 centals; wine grapes, 3,191,727 centals; and grapes for table use, 619,239 centals.

Of the fifty-seven counties in California, all but five reported grapevines, and nearly one fourth of the counties had over a million vines each.

Fresno, Sonoma, and Santa Clara are the leading counties in the cultivation of this fruit, reporting, in 1900, more than one third of the vines of the State. Fresno County alone produced 2,125,388 centals of raisin grapes, 522,529 centals of wine grapes, and 94,418 centals of grapes for table use.

Of the counties reporting large acreages in vines, the greatest number of varieties of wine grapes were grown in Sonoma, Santa Clara, Napa, Sacramento, Los Angeles, and Alameda, while grapes for table use and raisins were reported principally by the adjoining counties of Fresno, Kings, Tulare, and Madera.

VEGETABLES.

The value of all vegetables produced in the State in 1899, including the value of potatoes, sweet potatoes, onions, and sugar-beets, was $7,182,318. Of this amount 36.7 per cent represents the value of potatoes, a crop reported by 9,760 farmers, who obtained an average yield of 125 bushels per acre.

Aside from the land devoted to potatoes, sweet potatoes, onions, and sugar-beets, 30,194 acres were used in the growing of miscellaneous vegetables. Of this area the products of 9,908 acres were not reported in detail. Of the remaining 20,286 acres, concerning which detailed reports were received, 4,292 acres were devoted to tomatoes; 2,368, to asparagus; 2,123, to sweet corn; 2,024, to watermelons; 1,949, to cabbages; 1,654, to celery; 1,231, to green pease; 1,209 to pumpkins; and 3,436, to other vegetables.

SUGAR-BEETS.

Sugar-beets were reported in California in 1880, but it was not until within the last decade that their production became an important branch of agriculture in the State. In 1899, 863 farmers devoted to this crop an area of 41,242 acres, an average of 47.8 acres per farm. They obtained and sold from this land 356,535 tons of beets, an average yield of 8.6 tons per acre, and received therefrom $1,550,346, an average of $1,796 per farm, $38 per acre, and $4.35 per ton.

These beets were grown in seventeen counties in the central and southern coast regions; the counties of Ventura, Monterey, Santa Clara, and Alameda, ranking in the order named, reported 70.6 per cent of the total acreage.

FLORICULTURE.

Flowers and plants were grown for market in 1899 by 280 farmers, of whom 208 derived their principal income from the sale of floral products. These commercial florists had invested a capital of $1,280,281, of which $766,310 represents the value of land; $467,625, that of buildings and other improvements; $36,881, that of implements; and $9,465, that of livestock. They expended $110,705 for labor and $7,379 for fertilizers. The value of the flowers and plants grown by the commercial florists was $511,125, and that of those grown by others, $69,521.

NURSERIES.

Trees and shrubs valued at $558,329 were grown in 1899, by 245 farmers, of whom 141 derived their principal income from the sale of nursery stock. The farms of these commercial nurserymen were worth $1,725,945, of which $1,515,630 represents the value of land; $10,315, that of buildings; and $55,243, that of implements, machinery, and livestock. The expenditure for labor was $158,345, and for fertilizers, $8,607.

IRRIGATION IN CALIFORNIA.

Extracts from U. S. Census Bulletin.

California, with its varied topography, soil, and climate, offers an interesting field for the study of irrigation. No other State produces such a variety of crops, and in no other State have agricultural lands, as such, reached the selling price of the semi-tropical fruit orchards of Southern California. Except in a few localities there is not, in California, the absolute necessity for irrigation that exists in most other western states and territories. On nearly all of the lands that are irrigated some crops will grow, in ordinary seasons, without artificial application of water. The more valuable crops, however, usually require irrigation, and with it the yield of all crops is increased greatly. An irrigation system is an insurance against crop failure in years of drought.

California has two great mountain systems, the Sierra Nevada, extending along the eastern border, and the Coast Range, following the coast line. These systems are joined in the northern part of the State in the vicinity of Mount Shasta, and in the southern part near Mount Tehachapi. Between the two ranges lie the valleys of the Sacramento and San Joaquin rivers, containing most of the agricultural lands of the State. North of the Sacramento Valley is a rugged region drained by the Klamath River. In the extreme eastern portion of the State are a few rivers which flow east into the lakes situated near the California-Nevada boundary line, while along the entire coast are streams flowing from the Coast Range into the ocean. In the southern portion of the State, also, there are several small rivers of great agricultural importance.

For convenience the following divisions—arbitrary in a measure, but conforming as far as practicable to the natural drainage basin divisions—have been adopted: Counties bordering on San Francisco Bay—Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma; counties of the north coast—Del Norte, Humboldt, and Mendocino; counties drained by Klamath River—Siskiyou, and Trinity; counties drained by Sacramento River—Amador, Butte, Colusa, El Dorado, Glenn, Lake, Lassen, Modoc, Nevada, Placer, Plumas, Sacramento, Shasta, Sierra, Sutter, Tehama, Yolo, and Yuba; counties drained by San Joaquin River—Calaveras, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, Tulare, and Tuolumne; drained by Carson River—Alpine County; drained by Owens Lake—Inyo County; drained by Mono Lake and Walker River—Mono County; drained by San Benito River—San Benito County; coast counties from San Francisco Bay south, to and including Los Angeles County—Los Angeles, Monterey, San Luis Obispo, Santa Barbara, Santa Cruz, and Ventura; counties drained by Santa Ana River—Orange, Riverside, San Bernardino, and San Diego. A portion of the area of the counties included in the Sacramento River division is really in other and smaller drainage basins, the most important of which is the Honey Lake basin.

In certain localities the necessity and value of water for particular crops, and especially for fruit, has led to extraordinary and successful efforts to obtain it from underground sources. This is particularly true of Los Angeles, Orange, Riverside, Santa Clara, San Bernardino, and Tulare counties, although in nearly every county some irrigation from wells is reported.

Water is obtained from open streams, lakes, and springs by two methods, gravity and pumping. By the gravity system, water is directed into the ditches usually by temporary or permanent dams thrown across the streams, but in some cases the bottom of the ditch is made lower at its head than the bed of the stream, thus obviating the necessity of dam building. Sometimes the stream is dammed and the water allowed to flood the contiguous lands, no ditches being used. This method is employed chiefly along the Pitt River. In the lower portions of the Sacramento and San Joaquin valleys, several thousand acres of land are moistened by water let in through headgates built in the levees which protect the reclaimed marsh lands from the river. The construction and maintenance of these intake gates and the distributing ditches involve much labor and expense, and the acreage so watered has, therefore, been included with the irrigated area.

In 1899 there were operated in California 1,913 ditches receiving water from open streams, lakes, and springs by gravity, and used chiefly or solely for irrigation purposes. The total cost of constructing these ditches was $12,855,012 and the area in the census year was 1,248,178 acres, making the average cost of construction per acre irrigated in 1899, $10.30. The total length of the main ditches was 5,106 miles.

Santa Clara is the only county of the first division in which irrigation is practiced to any considerable extent. The water taken from streams, which is supplied principally by Penitencia Creek, is used chiefly for orchards, and is applied during the winter season, two or three applications generally being sufficient. In the other counties of this division irrigation is used chiefly for truck farms, although in Alameda County several hundred acres of alfalfa were irrigated from Alameda Creek and other small streams.

The coast counties north of San Francisco Bay have a heavy winter rainfall, and a summer precipitation from dews and fogs. There is some irrigation for truck gardens, and on the higher lands of Mendocino County a number of farmers apply water to their alfalfa fields. There are no large canals, each irrigator usually operating a small ditch of his own.

In 1899, 53,763 acres in Siskiyou and Trinity counties were irrigated from streams, principally the tributaries of the Klamath River. Irrigation is practiced chiefly for hay and forage crops. The ditches used are generally of simple construction and comparatively inexpensive.

From the Sacramento River and its many tributaries, and from the streams flowing into Honey Lake, 241,128 acres were irrigated in 1899. Gravity ditches used solely or chiefly for irrigation supplied 185,358 acres, while a large area was watered from canals used principally for mining purposes. In the northern counties of this division, the method of damming streams, causing them to flood the contiguous land, is often employed. Irrigation is sometimes used on the reclaimed marsh lands bordering the Sacramento River near its mouth.

The southern portion of the great interior basin of California is composed of the San Joaquin, Tulare, and Kern valleys. There are no distinct lines of demarcation between these valleys, and they are usually included in the general term "San Joaquin Valley," the San Joaquin River being the only drainage outlet to the sea. In this division 749,917 acres were irrigated in 1899, of which area 732,326 acres were supplied with water from streams, and a comparatively small acreage from ditches used principally for mining or power purposes. The owners of a number of farms which were formerly marsh lands, but are now protected from the river by levees, have successfully practiced irrigation by filling ditches with river water siphoned over the levees or let in through floodgates. In 1899 the number of ditches operated by gravity was 201, from which 724,329 acres were watered.

In Alpine, Mono, and Inyo counties, agriculture without irrigation is practically impossible, and in these counties in 1899, 104,614 acres were irrigated. The water was supplied by streams, and was conducted by ditches built for irrigation purposes.

There were six irrigation ditches in San Benito County in 1899, from which 1,868 acres were supplied with water. Alfalfa was the principal crop irrigated.

In the coast counties from San Francisco Bay south to and including Los Angeles County, the number of irrigation ditches obtaining water from streams by gravity in 1899 was 57. From these ditches 48,626 acres, principally in Los Angeles and Ventura counties, were irrigated. Water is used chiefly for orchards and for hay and forage crops.

In the three counties drained by the Santa Ana River there were, in 1899, 111,366 acres irrigated from streams by gravity ditches. In these counties, and in Los Angeles County, the water supply of several gravity systems is supplemented by water pumped from streams and wells, and in some instances by water from artesian wells. In the greater portion of California, most of the water in the rivers runs waste, but in the counties south of the San Joaquin Valley the flow of the streams is completely utilized.

In 1899, 11,780 acres in the State were irrigated with water pumped from open streams and lakes. The plants used were similar to those employed in pumping from wells. On the lower Sacramento River a barge fitted with two 15-inch rotary pumps driven by an engine of 150 horse-power, was successfully operated in irrigating the lands of its owners. The barge had a propelling wheel, and was rigged with pipes, derricks, etc., for lifting the water above the banks. This was the only floating plant reported.

Wells have an important place in the agricultural economy of California. Exclusive of the area watered from ditches whose stream supply was supplemented by water derived from underground sources, there were, in 1899, 152,566 acres irrigated from wells and tunnels. Water from streams is considered better for the soil than that from wells, as it fertilizes as well as moistens the land, while well water is sterile and often contains alkalies to a harmful degree. But, notwithstanding these admitted disadvantages, some prefer well irrigation, as the supply is certain and can be applied at the times and in the quantities desired.

Water is obtained from underground sources in three ways: By pumping from wells, by driving tunnels in the sides of hills and mountains, and by using flowing wells. Windmills are not generally employed, even the smaller plants being operated by steam, gasoline, or electricity. Many of the systems are large and expensive, and plants costing $10,000 or more, used for single farms, are not uncommon. Repairing is an important matter in the operation of pumping plants, not only on account of the expense, but because a breakdown might occur when the water is most needed. For this reason, and because they are more efficient, centrifugal and pneumatic pumps are preferred to plunger pumps. The principal elements governing the cost of operating a pumping plant are the kind and condition of the machinery, fuel, labor, the height to which the water must be lifted and the distance it must be carried, and repairing. As a rule, the larger the plant the less the cost of water per inch, and for this reason the farmers in many localities have built coöperative plants.

The fuel generally used is oil, either crude or distillate. With the development of California's oil-fields this fuel became cheaper, making it profitable to pump water for crops. The oil industry and irrigation are mutually helpful. In 1899 the highest price reported for crude oil was paid in Tulare County—7 cents per gallon for a drum of 110 gallons. The lowest price was reported from Santa Clara County—85 cents for a barrel of 42 gallons, or a little more than 2 cents per gallon. The price of distillate varied from 9 cents in Los Angeles County to 13 cents in Yolo County; and that of gasoline, from 15 cents in Santa Clara County to 20 cents in Colusa County. Most of the pumping plants in Santa Clara County use wood for fuel. Wood costs from $2.50 to $8.00 per cord. One irrigator reported that he had substituted an oil engine, using $2.10 worth of crude oil per day, for a wood-burning plant which, while consuming $8.00 worth of fuel per day, pumped only the same quantity of water. Coal is used to some extent, and a few plants burn the branches trimmed from orchards. Most of the plants in Tulare County are operated by electricity furnished by power companies.

CLIMATOLOGY FOR THE YEAR 1901.

By A. G. McADIE, Section Director, San Francisco.

January.—The mean temperature of the State, as determined from the records of 190 stations, was 43.9°, which was 0.2° above the normal. The highest recorded temperature was 85°, at Anaheim on the 19th, and the lowest was 26° below zero, at Boca on the 10th and Bodie on the 1st. The absolute range was 111°. The average precipitation, as determined from the records of 190 stations, was 5.21 inches, which was 0.74 inch above the normal. The greatest monthly precipitation was 24.46 inches, at Summerdale; and the least nothing, at Needles.

February.—The mean temperature was 47.7°, which was 0.8° above the normal. The highest recorded temperature was 98°, at Palm Springs on the 27th; and the lowest was 26° below zero, at Bodie on the 10th. The absolute range was 124°. The average precipitation was 6.03 inches, which was 2.73 inches above the normal. The greatest monthly precipitation was 22.45 inches, at Cisco, and the least 0.25 inch, at Keeler.

March.—The mean temperature was 53.0°, which was 2.1° above the normal. The highest recorded temperature was 95°, at Volcano on the 1st and Salton on the 6th, and the lowest was 14° below zero, at Bodie on the 13th. The absolute range was 109°. The average precipitation was 1.01 inches, which was 2.32 inches below the normal. The greatest monthly precipitation was 7.02 inches, at Crescent City, and the least nothing, at ten stations.

April.—The mean temperature was 55.8°, which was 1.9° below the normal. The highest recorded temperature was 102°, at Salton on the 21st, and the lowest was zero, at Bodie on the 4th and 5th. The absolute range was 102°. The average precipitation was 2.16 inches, which was 0.36 inch above the normal. The greatest monthly precipitation was 7.48 inches, at La Porte, and the least nothing, at ten stations.

May.—The mean temperature was 62.0°, which was 1.7° below the normal. The highest recorded temperature was 108°, at Volcano on the 16th, 17th, 18th, and 31st, and the lowest was 16°, at Bodie on the 1st. The absolute range was 92°. The average precipitation was 1.03 inches, which was 0.11 inch below the normal. The greatest monthly precipitation was 3.87 inches, at Cuyamaca, and the least nothing, at five stations.

June.—The mean temperature was 70.5°, which was 0.6° below the normal. The highest recorded temperature was 124°, at Salton and Volcano on the 28th, and the lowest was 16°, at Bodie on the 24th. The absolute range was 108°. The average precipitation was 0.01 inch, which was 0.26 inch below the normal. The greatest monthly precipitation was 0.43 inch, at Sierra Madre, and the least nothing, at more than two thirds of the stations.

July.—The mean temperature was 76.0°, which was 0.4° below the normal. The highest recorded temperature was 121°, at Volcano on the 6th, 8th, 9th, 12th, 18th, and 19th, and the lowest was 28°, at Bodie on the 3d. The absolute range was 93°. The average precipitation was 0.01 inch, which was 0.04 inch below the normal. The greatest monthly precipitation was 0.39 inch, at Bodie, and the least nothing, at more than half of the stations.

August.—The mean temperature was 75.6°, or normal. The highest recorded temperature was 124°, at Salton on the 26th, and the lowest was 24°, at Bodie on the 21st. The absolute range was 100°. The average precipitation was 0.12 inch, which was 0.05 inch above the normal. The greatest monthly precipitation was 2.50 inches, at Mammoth Tank, and the least nothing, at about half the stations.

September.—The mean temperature was 66.0°, which was 2.3° below the normal. The highest recorded temperature was 114°, at Volcano on the 17th, and the lowest was 15°, at Bodie on the 24th. The absolute range was 99°. The average precipitation was 0.94 inch, which was 0.55 inch above the normal. The greatest monthly precipitation was 6.28 inches, at Crescent City, and the least nothing at 28 stations.

October.—The mean temperature was 63.2°, which was 2.4° above the normal. The highest recorded temperature was 112°, at Salton on the 19th, and the lowest was 10°, at Bodie on the 28th. The absolute range was 102°. The average precipitation was 1.50 inches, which was 0.32 inch above the normal. The greatest monthly precipitation was 5.71 inches at Auburn, and the least nothing, at six stations.

November.—The mean temperature was 54.9°, which was 2.5° above the normal. The highest recorded temperature was 100°, at Craftonville on the 6th, and the lowest was 5°, at Bodie on the 11th. The absolute range was 95°. The average precipitation was 2.65 inches, which was 0.46 inch above the normal. The greatest monthly precipitation was 12.85 inches, at Upper Mattole, and the least nothing, at ten stations.

December.—The mean temperature was 47.4°, which was 1.1° above the normal. The highest recorded temperature was 90° at Elsinore on the 18th, and the lowest was 5° below zero, at Bodie on the 13th. The absolute range was 95°. The average precipitation was 1.45 inches, which was 2.63 inches below the normal. The greatest monthly precipitation was 9.50 inches, at Crescent City, and the least nothing, at 31 stations.

Annual.—The highest temperature recorded in the State during the year was 124°, at Salton and Volcano June 28th, and at Salton August 26th; the lowest was 26° below zero, at Bodie January 1st and February 10th, and at Boca January 10th. The mean temperature for the State was 0.2° above the normal. The greatest monthly precipitation was 24.46 inches, at Summerdale during January.

COMPARATIVE TABLE OF THE TEMPERATURES AND RAINFALL FOR TEN YEARS.

NOTE.—Red Bluff, located in northern extremity of the Sacramento Valley; Sacramento, central of that valley; San Francisco, representing the coast region; Fresno, central of San Joaquin Valley; Los Angeles, representing Southern California.

YEAR.	RED BLUFF.				SACRAMENTO.				FRESNO.				LOS ANGELES.				SAN FRANCISCO.			
	Temperature.			Rainfall....	Temperature.			Rainfall..	Temperature.			Rainfall....	Temperature.			Rainfall....	Temperature.			Rainfall....
	Mean.	Max.	Min.		Mean.	Max.	Min.		Mean.	Max.	Min.		Mean.	Max.	Min.		Mean.	Max.	Min.	
	deg.	*deg.*	*deg.*	*ins.*	*deg.*	*deg.*	*deg.*	*ins.*	*deg.*	*deg.*	*deg.*	*ins.*	*deg.*	*deg.*	*deg.*	*ins.*	*deg.*	*deg.*	*deg.*	*ins.*
1891	62.4	114	26	23.04	60.6	106	26	15.63	63.0	114	26	8.94	63.0	109	33	12.84	56.6	100	37	21.11
1892	62.2	108	28	33.48	60.2	106	26	23.60	63.1	112	27	8.75	61.6	99	33	18.72	56.0	92	38	22.08
1893	60.6	106	27	24.36	58.8	103	28	16.59	61.0	109	28	9.40	61.5	92	31	21.96	54.3	90	36	17.91
1894	62.0	110	27	26.98	60.3	108	26	22.61	62.6	109	25	12.48	60.3	99	32	7.51	55.1	94	36	24.32
1895	62.2	108	28	22.57	60.2	102	28	17.38	62.5	110	26	10.39	61.7	100	34	12.55	55.6	89	38	17.13
1896	62.5	109	26	28.46	60.7	104	28	25.06	63.7	111	28	11.02	63.1	103	35	11.80	55.9	91	33	28.25
1897	62.0	109	27	20.08	59.8	105	24	15.32	62.3	110	23	8.41	61.8	97	30	14.28	55.0	92	38	16.40
1898	62.5	112	24	12.91	59.5	110	26	10.04	63.1	114	24	4.99	62.5	99	31	4.83	54.6	89	36	9.31
1899	62.4	109	26	28.07	59.6	102	30	21.14	62.6	111	24	10.54	62.0	100	33	8.69	55.0	94	34	23.23
1900	62.4	109	29	21.77	59.9	102	30	17.91	62.8	109	26	11.06	63.5	96	37	11.30	56.2	92	40	15.33
1901	63.1	111	25	25.51	60.1	105	26	18.52	63.5	110	27	8.07	62.1	97	31	11.96	55.2	91	37	19.75

AREA OF UNAPPROPRIATED UNITED STATES LAND IN CALIFORNIA.

Compiled by the United States General Land Office, July 1st, 1901.

Land District.	County.	Area Unappropriated and Unreserved.			Brief description of character of unappropriated and unreserved land.
		Surveyed.	Unsurvey'd	Total.	
Eureka.	Del Norte	418,020	52,982	471,002	Very rough, broken, and mountainous; timber, grazing, and mineral.
	Humboldt	452,683	94,266	546,949	Mountainous; grazing and timber land; some mineral.
	Mendocino	43,649	6,580	50,229	Mountainous; timber and grazing.
	Shasta	2,480		2,480	Mountainous; timber and grazing.
	Siskiyou	1,008,295	61,321	1,069,616	Very mountainous; timber, grazing, and mineral land.
	Trinity	989,530	45,294	1,034,824	Mountainous; grazing, timber, and mineral land.
	Total	2,914,657	260,443	3,175,100	
Independence.	Alpine	19,114		19,114	Mountainous; grazing.
	Fresno				No vacant public land.
	Inyo	3,334,711	2,386,980	5,721,691	Mountainous; agricultural, mineral.
	Kern	788,288	92,000	880,288	Mountainous; arid, grazing.
	Madera				No vacant public land.
	Mariposa				No vacant public land.
	Mono	1,377,003	207,600	1,584,603	Grazing, agricultural, mineral.
	San Bernd'o	3,277,696	922,094	4,199,790	Arid, mineral.
	Tulare				No vacant public land.
	Tuolumne				No vacant public land.
	Total	8,796,812	3,608,674	12,405,486	
Los Angeles.	Kern	196,995	16,221	213,216	Arid, level, desert, mountainous.
	Los Angeles	623,986	243,007	866,993	Arid, level, desert, mountainous.
	Orange	19,687	1,956	21,643	Mountainous and hilly.
	Riverside	1,915,840	693,910	2,609,750	Mountainous, rolling, level desert.
	San Bernd'o	2,453,425	1,113,691	3,567,116	Mountainous, rolling, level desert.
	San Diego	2,725,232	599,322	3,324,554	Mountainous, rolling, level desert.
	Santa Barb.	135,763	33,135	168,898	Mountainous and rolling.
	Ventura	63,154	58,093	121,247	Mountainous and rolling.
	Total	8,134,082	2,759,335	10,893,417	
Marysville.	Butte	93,059	13,056	106,115	Grazing, mineral, and timber.
	Colusa	39,393	1,490	40,883	Agricultural and grazing.
	Glenn	81,675	960	82,635	Agricultural and grazing.
	Lake	9,239		9,239	Hilly; agricultural and grazing.
	Napa	15,800	664	16,464	Hilly; agricultural and grazing.
	Nevada	11,897	11,760	23,657	Hilly; mineral and grazing.
	Placer				No vacant public land.
	Plumas	293,313	103,240	396,553	Mountainous; mineral and timber.
	Sierra	27,106	34,200	61,306	Mountainous; mineral and timber.
	Solano				No vacant public land.
	Sutter	1,271	630	1,901	Agricultural and fruit land.
	Tehama	78,198	4,075	82,273	Grazing and agricultural.
	Yolo	41,524	880	42,404	Grazing and agricultural.
	Yuba	62,874		62,874	Agricultural, timber, and mineral.
	Total	755,349	170,955	926,304	

AREA OF UNAPPROPRIATED UNITED STATES LAND IN CALIFORNIA—Continued.

Land District.	County.	AREA UNAPPROPRIATED AND UNRESERVED.			Brief description of character of unappropriated and unreserved land.
		Surveyed.	Unsurvey'd	Total.	
Redding.	Butte	2,840	----------	2,840	Mountainous land; timbered.
	Modoc	97,799	32,430	130,229	Mostly mountainous timber land.
	Plumas	2,500	----------	2,500	Mostly mountainous timber land.
	Shasta	849,820	39,075	888,895	Farming, grazing, timber, mineral.
	Siskiyou	1,020,311	167,136	1,187,447	Farming, grazing, timber, mineral.
	Tehama	338,775	19,398	358,173	Mostly foothill and grazing land.
	Trinity	377,335	8,119	385,474	Mountainous; timber, grazing, and mineral.
	Total	2,689,400	266,158	2,955,558	
Sacramento.	Alpine	91,802	96,662	188,464	Grazing, desert.
	Amador	93,461	12,620	106,081	Grazing, timber, mineral.
	Calaveras	112,509	24,280	136,789	Grazing, timber, mineral.
	Contra Costa	----------	----------	----------	No vacant public land.
	El Dorado	179,625	63,479	243,104	Timber and grazing.
	Mono	10,000	4,380	14,380	Grazing, mineral.
	Nevada	88,144	14,060	102,204	Mineral, timber.
	Placer	79,153	25,134	104,287	Mineral, timber, and grazing.
	Plumas	15,020	----------	15,020	Grazing.
	Sacramento	11,585	----------	11,585	Farming and grazing.
	San Joaquin	----------	----------	----------	No vacant public land
	Sierra	194,714	32,533	227,247	Grazing and timber.
	Solano	2,970	----------	2,970	Agricultural.
	Sutter	16,498	----------	16,498	Mineral and timber.
	Tuolumne	41,537	16,390	57,927	Timber, grazing.
	Yolo	9,000	----------	9,000	Farming and grazing.
	Yuba	850	----------	850	Grazing and mineral.
	Total	946,868	289,538	1,236,406	
San Francisco.	Alameda	2,167	----------	2,167	Mountain land.
	Colusa	2,231	8,500	10,731	Mountain land.
	Contra Costa	----------	----------	----------	No vacant public land.
	Fresno	80,059	2,560	82,619	Mountain land.
	Glenn	114,901	----------	114,901	Mountain land.
	Kern	8,714	14,447	23,161	Mountain land.
	Kings	7,520	----------	7,520	Mountain land.
	Lake	384,593	----------	384,593	Mountain land.
	Marin	----------	----------	----------	No vacant public land.
	Mendocino	567,646	119,246	686,892	Mountain land.
	Merced	56,150	----------	56,150	Mountain land.
	Monterey	973,287	3,994	977,281	Mountain land.
	Napa	87,134	11,520	98,654	Mountain land.
	Sacramento	----------	----------	----------	No vacant public land.
	San Benito	355,477	5,115	360,592	Mountain land.
	San Fran.	----------	----------	----------	No vacant public land.
	San Joaquin	24,720	----------	24,720	Mountain land.
	S. L. Obispo	641,009	5,703	646,712	Mountain land.
	San Mateo	----------	----------	----------	No vacant public land.
	Santa Barb.	38,605	1,563	40,168	Mountain land.
	Santa Clara	28,068	5,482	33,550	Mountain land.
	Santa Cruz	----------	----------	----------	No vacant public land.
	Solano	82,412	----------	82,412	Mountain land.
	Sonoma	119,522	24,157	143,679	Mountain land.
	Stanislaus	29,781	5,737	35,518	Mountain land.
	Tehama	119,915	800	120,715	Mountain land.
	Trinity	8,680	----------	8,680	Mountain land.
	Ventura	25,202	----------	25,202	Mountain land.
	Yolo	----------	----------	----------	No vacant public land.
	Total	3,757,793	208,824	3,966,617	

AREA OF UNAPPROPRIATED UNITED STATES LAND IN CALIFORNIA—Continued.

Land District.	County.	Area Unappropriated and Unreserved.			Brief description of character of unappropriated and unreserved land.
		Surveyed.	Unsurvey'd	Total.	
Stockton.	Amador	------	------	------	No vacant public land.
	Calaveras	5,554	1,320	6,874	Hilly; farming, grazing, mining.
	Fresno	181,861	23,714	205,575	Hilly; farming, grazing, mining.
	Madera	250,297	11,817	262,114	Hilly; grazing, farming.
	Mariposa	116,868	7,014	123,882	Mountainous; mining, farming, grazing, timber.
	Merced	11,099	------	11,099	Rolling foothills; farming, grazing.
	Sacramento	------	------	------	No vacant public land.
	San Joaquin	241	------	241	Farming.
	Santa Clara	------	------	------	No vacant public land.
	Stanislaus	31,214	------	31,214	Foothills; farming and grazing.
	Tuolumne	126,685	15,059	141,744	Hilly, mountainous; mining, farming, grazing.
	Total	723,819	58,924	782,743	
Susanville.	Lassen	2,368,179	54,753	2,422,932	Timber, desert, grazing, mineral.
	Modoc	1,608,689	127,615	1,736,304	Timber, desert, grazing, farming.
	Plumas	744,345	64,524	808,869	Mountainous; timber, mineral.
	Shasta	11,000	------	11,000	Mountainous.
	Sierra	52,999	------	52,999	Timber, desert, grazing, mountainous, and mineral.
	Tehama	3,480	7,520	11,000	Mountainous.
	Total	4,788,692	254,412	5,043,104	
Visalia.	Fresno	218,171	11,840	230,011	Mountainous; grazing, timber.
	Kern	202,059	56,441	258,500	Arid plains and mountainous.
	Kings	20,552	------	20,552	Mountainous; arid plains.
	Madera	------	------	------	No vacant public land.
	Merced	7,481	------	7,481	Mountainous; grazing.
	Monterey	2,400	------	2,400	Mountainous; grazing.
	San Benito	9,118	------	9,118	Mountainous; grazing.
	S. L. Obispo	29,955	------	29,955	Mountainous; grazing.
	Tulare	55,388	50,868	106,256	Arid plains and mountainous; timber.
	Total	545,124	119,149	664,273	
	Total in California	34,052,596	7,996,412	42,049,008	

CALIFORNIA PRODUCTS.

The annual yield of some of the leading products of the State, with approximate values, for a series of years, and trade estimates for 1901, are as follows:

(From San Francisco Chamber of Commerce.)

Year.	Dried Prunes.		Dried Apples.		Dried Peaches.	
	Pounds	Value.	Pounds.	Value.	Pounds.	Value.
1892	22,500,000	$1,140,000	2,750,000	$170,000	13,500,000	$940,000
1893	52,180,000	2,000,000	3,800,000	230,000	16,800,000	1,160,000
1894	44,750,000	1,700,000	5,850,000	350,000	30,540,000	2,120,000
1895	64,500,000	2,800,000	4,560,000	275,000	24,500,000	1,705,000
1896	55,200,000	2,400,000	2,350,000	140,000	16,460,000	1,050,000
1897	97,780,000	3,750,000	5,250,000	320,000	27,150,000	1,890,000
1898	90,420,000	3,600,000	3,520,000	215,000	10,960,000	765,000
1899	112,827,000	3,950,000	5,900,000	356,000	34,800,000	2,430,000
1900	159,460,000	4,650,000	6,360,000	390,500	34,340,000	2,260,000
1901	72,000,000	2,600,000	6,000,000	350,000	21,500,000	1,500,000

Year.	Dried Apricots.		Dried Pears.		Dried Plums.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1892	12,500,000	$1,040,000	2,250,000	$157,500	2,000,000	$84,000
1893	9,500,000	800,000	2,640,000	180,750	1,500,000	62,000
1894	28,750,000	2,250,000	6,530,000	457,200	2,760,000	112,500
1895	10,650,000	900,000	5,400,000	375,000	4,500,000	190,000
1896	6,740,000	610,000	9,650,000	675,500	2,100,000	87,000
1897	30,125,000	2,450,000	6,350,000	434,000	3,250,000	135,000
1898	8,240,000	750,000	6,620,000	460,000	2,460,000	100,000
1899	11,600,000	925,000	5,760,000	403,000	3,360,000	136,000
1900	28,080,000	2,250,000	14,550,000	1,018,500	3,900,000	160,000
1901	11,650,000	930,000	7,000,000	500,000	4,100,000	165,000

Year.	Dried Nectarines.		Dried Figs.		Dried Grapes.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1892	720,000	$45,000	500,000	$25,000	4,000,000	$120,000
1893	780,000	47,500	890,000	45,000	4,880,000	145,000
1894	1,250,000	75,000	1,550,000	77,500	4,510,000	135,000
1895	1,325,000	80,000	2,750,000	140,000	4,250,000	125,000
1896	625,000	37,500	2,165,000	108,000	2,700,000	80,000
1897	285,000	17,250	3,250,000	160,000	3,450,000	103,000
1898	190,000	12,000	4,780,000	240,000	640,000	19,000
1899	840,000	50,500	5,800,000	290,000	450,000	13,000
1900	875,000	52,500	6,000,000	300,000	480,000	14,500
1901	690,000	42,000	5,600,000	285,000	400,000	14,000

ANNUAL YIELD OF PRODUCTS OF CALIFORNIA—Continued.

Year.	Hops.		Walnuts.		Almonds.		Canned Fruits.
	Bales.	Pounds.	Pounds.	Value.	Pounds.	Value.	Cases.*
1892	39,800	7,800,000	2,950,000	$205,000	1,066,000	$120,000	1,602,370
1893	51,400	10,074,400	2,866,000	200,000	720,000	80,000	1,001,640
1894	67,500	13,230,000	5,805,000	420,000	2,125,000	235,000	1,528,830
1895	52,000	10,192,000	4,620,000	325,000	1,850,000	205,000	1,639,800
1896	35,000	6,860,000	8,230,000	580,000	3,210,000	356,000	1,602,450
1897	45,000	8,820,000	7,970,000	490,000	4,750,000	525,000	1,942,982
1898	44,500	8,722,000	11,300,000	795,000	900,000	100,000	2,085,166
1899	59,000	11,564,000	11,160,000	789,000	4,640,000	515,000	3,003,170
1900	36,000	7,056,000	10,860,000	775,000	5,480,000	600,000	2,775,896
1901	45,000	8,820,000	12,500,000	890,000	2,200,000	245,000	2,275,700

Year.	Oranges.		Lemons.		Honey.	Beet Sugar.	Raisins.	
	Cars.	Boxes.	Cars.	Boxes.	Pounds.	Pounds.	Pounds.	Value.
1892	5,806	1,939,204	65	21,710	1,240,000	8,624,890	57,000,000	$2,900,000
1893	4,877	1,617,918	145	48,430	2,680,000	21,801,330	85,000,000	4,300,000
1894	7,240	2,418,160	335	111,890	4,275,000	40,204,100	103,000,000	5,180,000
1895	6,350	2,120,900	565	186,610	4,000,000	49,232,700	93,160,000	4,672,000
1896	5,972	1,994,648	1,378	460,252	5,350,000	64,510,000	68,230,600	3,430,000
1897	12,995	4,340,330	2,410	804,940	7,878,000	70,740,000	93,704,000	4,725,000
1898	9,645	3,221,430	1,230	410,820	1,820,000	36,180,000	80,631,000	4,050,000
1899	15,880	5,748,560	2,520	781,200	2,822,000	64,890,000	71,568,000	3,590,000
1900	21,640	7,833,680	3,260	1,010,600	2,208,000	60,638,000	94,335,000	4,740,000
1901	22,500	8,145,000	3,500	1,085,000	4,600,000	160,000,000	72,000,000	3,640,000

* A case of canned fruit consists of 2 dozen 2½-lb. tins.

PRODUCTS OF NORTHERN AND SOUTHERN CALIFORNIA (FROM ORCHARDS, VINEYARDS, AND GARDENS) SHIPPED OUT OF THE STATE.

	Northern California.	Southern California.
	Carloads.	*Carloads.*
Green deciduous fruits	9,344	23
Dried fruits	10,114	585
Raisins	4,172	160
Canned fruits	7,692	630
Nuts	190	656
Citrus fruits	2,088	30,298
Wine and brandy	8,475	129
Vegetables	6,375	2,798
Totals	48,450	35,279

From this table it will be seen that the fruit crop of Southern California is almost exclusively citrus fruits.

FRESH FRUIT SHIPMENTS.

The number of cars of deciduous fruits forwarded by rail from California during the past seven years were as follows:

Varieties.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Pears	1,187	1,624	1,640	1,595	1,684	2,115	1,535
Peaches	1,289	976	1,316	1,103	2,625	1,361	1,901
Grapes	1,010	712	1,100	734	847	825	966
Plums and prunes	465	407	742	542	885	1,158	936
Apricots	162	172	177	123	90	152	201
Cherries	180	88	239	297	85	238	110
Apples	105	53	61	596	490	512	739
Quinces	13	8	24	1	19	10	13
Figs	--------	2	3	--------	--------	--------	--------
Nectarines	5	1	10	--------	2	--------	2
Persimmons	--------	--------	2	1	1	3	2
Mixed	152	9	9	15	24	27	23
Cars not reported	--------	--------	--------	--------	117	34	31
Totals	4,568	4,052	5,323	5,007	6,869	6,435	6,459

SHIPMENTS OF VEGETABLES OUT OF STATE IN 1901.

By Rail. (Tons of 2,000 pounds.)

Place of Shipment.	Green Vegetables.	Canned Vegetables.
Northern California.		
San Francisco	20,442.8	555.8
Oakland	784.1	3,230.2
San José	982.1	1,432.2
Stockton	11,567.3	40.8
Sacramento	9,794.8	1,972.5
Marysville	339.5	----------
Other points not designated	4,591.8	----------
Total tons	48,502.4	7,231.5
Total carloads, ten tons each	4,850.2	723.1
Southern California.		
Los Angeles	26,397.3	231.5
Orange County	1,199.7	----------
Riverside County	7.9	----------
San Bernardino County	132.7	----------
San Diego County	15.0	----------
Total tons	27,752.6	231.5
Total carloads, ten tons each	2,775.3	23.1

By Sea. (Tons of 2,000 pounds.)

San Francisco	7,832.4	179.8

By Rail and By Sea. (Carloads of ten tons each.)

Total carloads by rail	7,625.5	746.2
Total carloads by sea	783.2	17.9
Total carloads from State	8,408.7	764.1

CALIFORNIA WINES AND BRANDY—YEARLY PRODUCTION.

Year Ending June 30.	Wine.	Brandy.
	Gallons.	*Gallons.*
1889–90	17,500,000	1,072,957
1890–91	20,000,000	1,245,698
1891–92	15,000,000	1,475,525
1892–93	24,700,000	2,209,617
1893–94	14,000,000	2,007,965
1894–95	18,000,000	1,754,062
1895–96	17,000,000	2,090,000
1896–97	16,400,000	1,442,468
1897–98	31,500,000	1,250,000
1898–99	19,000,000	1,690,000
1899–00	23,500,000	871,968
1900–01	17,250,000	1,250,210

BUTTER AND CHEESE PRODUCED IN THE STATE.

Compiled by the State Dairy Bureau.

Year.	BUTTER.			CHEESE.
	Creamery Method.	Old Method.	Total.	
	lbs.	*lbs.*	*lbs.*	*lbs.*
1896	10,097,323	21,508,117	31,605,440	6,383,130
1897	10,866,646	17,811,793	28,678,439	6,399,625
1898	10,410,479	13,280,549	23,691,028	5,148,372
1899	12,725,814	12,143,270	24,869,084	5,294,938
1900	16,486,695	12,296,164	28,782,859	4,989,960
1901	19,017,512	10,713,370	29,730,882	5,679,566

RECEIPTS OF DAIRY PRODUCE.

The receipts of butter, cheese, and eggs at San Francisco during 1901 were as follows:

Sources.	Butter.	Cheese.	Eggs.
	lbs.	*lbs.*	*doz.*
California	14,333,172	3,828,490	8,564,940
Oregon, etc.	966,100	269,260	29,970
Eastern	154,510	575,280	1,779,690
Totals, 1901	15,453,782	4,673,030	10,374,600
Totals, 1900	17,582,500	5,640,680	7,720,296
Totals, 1899	13,807,300	6,092,840	7,120,654
Totals, 1898	15,606,050	4,777,300	6,101,405
Totals, 1897	14,634,000	6,036,420	5,442,202
Totals, 1896	13,769,850	5,124,660	4,941,967
Totals, 1895	14,344,300	5,257,900	4,932,204
Totals, 1894	17,257,100	6,689,620	4,881,375
Totals, 1893	17,037,900	6,750,000	4,715,711
Totals, 1892	14,677,300	7,497,900	5,308,908
Totals, 1891	12,881,950	6,637,600	5,070,668
Totals, 1890	12,583,400	6,835,700	6,122,776
Totals, 1889	12,123,200	5,889,000	5,836,203

CALIFORNIA'S WHEAT CROP (INCLUDING FLOUR) FOR 9 YEARS—1891-1901.

Crop Year.	Wheat—Tons.
1892-93	1,022,298
1893-94	995,232
1894-95	716,792
1895-96	786,522
1896-97	872,602
1897-98	917,589
1898-99	367,061
1899-00	973,102
1900-01	611,536

CEREAL EXPORTS—1892-1901.

The clearances of flour and grain cargoes from San Francisco, by sea, for a series of years, are as follows:

Year.	Flour.	Wheat.	Barley.	Oats.	Corn.	Rye.
	bbls.	*ctls.*	*ctls.*	*ctls.*	*ctls.*	*ctls.*
1892	1,077,956	9,726,697	1,323,495	21,982	70,648	32,420
1893	872,506	10,880,219	2,817,151	19,856	95,867	33,739
1894	787,432	7,144,017	1,058,172	21,430	178,320	12
1895	949,981	11,047,414	1,622,567	16,204	46,011	----------
1896	1,172,733	12,182,706	3,856,394	32,312	30,351	152,437
1897	869,437	9,508,591	3,405,832	23,362	78,483	69,792
1898	831,083	3,973,536	786,303	28,308	31,633	29
1899	1,077,580	3,247,102	3,167,383	31,033	21,389	54,215
1900	1,260,202	7,752,722	2,489,826	234,613	13,002	49,240
1901	1,169,184	9,294,538	4,072,241	151,704	10,792	144,446

WOOL PRODUCTION OF CALIFORNIA—1890-1901.

Compiled by CHAS. H. ABBOTT, Esq.

Year.	Pounds.
1890	34,854,640
1891	33,183,475
1892	35,802,939
1893	33,169,375
1894	36,968,400
1895	35,856,690
1896	27,195,550
1897	34,882,325
1898	28,063,240
1899	28,332,090
1900	27,750,000
1901	26,900,000

IMPORTATIONS OF LIVESTOCK AND PACKING-HOUSE PRODUCTS.

The following statistics, furnished by the two great railway systems of this State, give the amount, in pounds, of the shipments of livestock and dairy and packing-house products into California for the fiscal year ending June 30, 1901:

SOUTHERN PACIFIC SYSTEM.

Statement showing Receipts of Shipments of Dairy Products, Packing-House Products, and Livestock at points on this Company's lines in California from points beyond Portland, Ogden, Mojave, Deming, and El Paso, for the fiscal year ending June 30, 1901:

	Pounds.
Butter	250,780
Cheese	1,748,650
Condensed Milk	6,537,190
Eggs	5,065,300
Poultry	8,260,190
Cattle	12,203,800
Sheep	1,223,600
Hogs	15,007,870
Packing-house products	36,148,400
Total	86,445,780

SANTA FE SYSTEM.

Statement showing Receipts of Shipments of Poultry, Eggs, Butter, Cheese, Packing-House Products, Cattle, Sheep, and Hogs imported into the State of California by the Santa Fe System, for the year ending June 30, 1901:

	Pounds.
Poultry and Eggs	3,835,300
Butter and Cheese	714,200
Packing-house products	12,343,900
Cattle, Sheep, Hogs, etc.	34,972,800
Total	51,866,200

RESOURCES

OF THE

STATE OF CALIFORNIA.

(BY COUNTIES.)

ALAMEDA COUNTY.

Alameda County fronts the bay of San Francisco, and lies opposite to San Francisco and the Golden Gate. It is bounded on the north by Contra Costa County, on the east by San Joaquin County, on the south by Santa Clara County, and on the west along its entire length by the bay of San Francisco. Its area is 737 square miles, or 471,680 acres.

For a distance of 36 miles, Alameda County fronts upon the bay, with an average width of 25 miles, extending to and beyond the summit of the Contra Costa Hills, comprising numerous beautiful valleys, besides the broad Alameda Valley, which last is bounded by the waters of the bay on the one side and the Contra Costa Hills on the other, and is one of the richest and most fertile valleys in the State. Among the most important of the smaller valleys are Livermore, Sunol, Castro, Amador, and Moraga, all richly endowed by nature with most productive soils, where flourish the grape, olive, fig, orange, and most of the semi-tropical fruits, and beautified with perennial flowers. The Contra Costa Hills, themselves, are well adapted to the cultivation of the olive, and the time is not far distant when the whole range of hills will be covered with these beautiful trees.

The principal stream in this county, Alameda Creek, rises in the Mount Diablo range, near Livermore Pass, and running through a cañon in the Contra Costa range, empties into San Francisco Bay, supplying water-power for several mills on the way. It is also navigable for schooners and light-draught crafts for several miles. There are several other creeks crossing the county and emptying into the bay, two of which furnish water for the city of Oakland. By the construction of a high dam at a narrow gorge in the hills, San Leandro Creek is made to form Lake Chabot, half a mile in width by 2 miles in length.

The range of hills, as has been stated, extending the whole length of the bay-front of the county, at a distance from the bay ranging from 5 to 10 miles, reach their highest altitude at Mission San José, at the southern end of the county, in Mission Peak, the highest point being 2,275 feet above tide-water. In early days these hills were covered with giant redwood trees; some of the old stumps remaining measure from 6 to 10 feet in diameter. The timber was cut away by the early pioneers, the lumber being used to build up San Francisco in the days of '49 and '50, until scarcely a redwood is found of any dimensions.

The country around Haywards was once a great grain-growing region, but its special adaptability for fine fruits is causing large tracts to be set out in orchards. Even now this district is one of the great fruit-raising regions, many millions of pounds being annually shipped.

SOILS.

The soils of this county that are immediately along the bay in Alameda Valley and the marshes formed by the overflow, are heavy, but very fertile when reclaimed. Then comes a broad belt of rich, black adobe. This belt is crossed by sedimentary deposits of alluvial land made by shifting channels of streams running down from the Coast Range. In the Niles region are lighter loams. About Livermore are uplands, bench and valley lands. Between the latter two classes the difference in potash, lime, and phosphoric acid accounts for difference in grape crop.

Mission San José is characterized by gravelly, upland, adobe soil, and was evidently chosen by the padres of the old mission for its exemption from frost, caused by its slight elevation above the surrounding valleys.

At Pleasanton the section tributary consists of agricultural and grazing lands. The soil is very rich sediment bottom, producing hay, grain, potatoes, hops, and beets in abundance.

At Alvarado the surrounding country is a fine farming and fruit region, and gardening and dairying are also largely carried on. The fertile, alluvial soil of the country about is finely adapted to fruit-growing.

CLIMATE.

The climate of Alameda County is unsurpassed for equability and salubrity, never reaching the extremes of heat or cold, the nights being always cool. Bordering on the bay, the county is subject to frequent fogs during the spring months, but these are not usually dense or of long duration. It is sheltered from the chilly winds of the ocean by the peninsula of San Francisco and the intervening bay.

The average temperature of Alameda County ranges about 52° in winter and 67° in summer; while in some of the cozy valleys the average is still more favorable. The county lies in about the same latitude as New York City, the average of which is 71° in summer and 31° in winter. In the immediate vicinity of Mission San José, in this county, embracing a territory 2 miles in width and 12 miles in length, the variation of temperature is less than in any other section of California; it is in every sense of the word a semi-tropical belt, where frosts are not known, and where even tropical fruits and plants grow and thrive.

FRUIT CULTURE.

Alameda County was among the first in the State to begin the planting of orchards and vineyards, but it called for a great deal of experiment to determine to what particular fruits the different sections were best adapted; after forty years of trial those questions are now pretty well settled. As all Gaul was divided into three parts, so this county is divisible into three sections—the cherry district, the apricot district, and the vineyard district.

From Oakland to Haywards is the home of the cherry; nowhere on the Pacific Coast does this fruit grow to greater perfection, and of the many hundred acres devoted to it, a majority have been very profitable, excepting of course in years like the last one, when frosts and untimely rains stripped the trees of blossoms and young fruit, causing an almost total failure. Disasters like this do not often occur, and in an ordinary year the cherry crop is good for a profit of a quarter of a million dollars. There have been some failures due to other causes, such as the selection of poor varieties and low prices, but during the last five years there has been no time when Royal Ann cherries, the favorite canning variety, did not command five cents a pound, and that means a good profit.

The apricot section of Alameda County includes all the region east and south of Haywards, but the center of the business is at Niles, and this region is as favorable for apricots as the San Leandro region is for cherries. While the apricot is grown in nearly all fruit-producing regions of California, there are few, if indeed there are any, where it comes to the perfection which it attains in the vicinity of Niles. While in the Sacramento and San Joaquin valleys the peach flourishes as it does nowhere else, the apricot is apt to be pale in color and lacking in flavor; but in this county it is high colored and the flavor is exquisite. One of the most popular varieties, the Alameda Hemskirk, was originated here. The other varieties which are preferred are the Blenheim and the Moorpark.

A first-class apricot orchard in Alameda County is easily worth $500 per acre, and some could not be bought for $750 or $800. There are a few specially good pieces of land which without trees are worth $400 to $500 to the right parties, because in orcharding, as in other lines of business, there is as much in the man as there is in the opportunity.

While cherries and apricots are the king and queen of fruits in this county, there are others which do well, among them being the Bartlett pear. Last year Alameda had the best crop of Bartletts of any county in the State, according to a leading representative of the canneries. Plums are another fruit which thrives, and the smaller fruits and berries find no more congenial home anywhere. There are also many fine orchards of peaches, but it is hardly a peach county, nor is it so well adapted to prunes as Santa Clara. The peach calls for a sediment loam soil and a higher temperature than is generally found here.

The future of the fruit industry in Alameda County may be expected to be one of steady advance; there are many thousand acres of grain land which will some day be turned into orchards, but the period of reckless planting has gone by; the man who knows how can make money, but the one who intends merely to speculate in orchards will naturally look to some other region where land is cheaper.

New commercial channels for the standard fruits open from time to time, and the two chief orchard products of this county, cherries and apricots, have been helped by recent developments.

VEGETABLE INDUSTRY.

Alameda is par excellence the vegetable-producing county on the Coast. It has led in this industry for a long time, and the area devoted to vegetables has been increasing lately at a rapid rate, since the profit which is found in peas, potatoes, tomatoes, rhubarb, asparagus, and several other vegetables is large enough to tempt the owners of the best soil to go into the business. Twelve or fifteen years ago the production of early vegetables for the San Francisco market was the most important part of the industry, and this was conducted largely by the Portuguese, who secured locations on the hillsides from Warm Springs around to Haywards and San Leandro.

This hillside region produces the earliest vegetables in the State, or as early as any, and the potatoes and peas grown here commence coming into market even before spring has arrived, for the winter rains are all that are needed to bring forward the crop in this belt, which is practically frostless. But, while years ago this early vegetable growing represented the predominant industry, and while it is still a rather important one, it probably does not pay as well as it did formerly, since now early vegetables are brought in from Arizona and other southern regions.

The center of the vegetable industry now lies elsewhere. It is found very profitable to grow certain vegetables on the deep rich valley lands, which, although they do not produce so early, bear much larger crops. No very accurate figures on the acreage devoted to vegetables in this county can be obtained, but fairly trustworthy estimates have been made by many persons who have opportunities to know. One of these estimates is that there are 8,000 acres devoted to vegetables in Alameda County, not including sugar-beets, which would add 4,000 or 5,000 acres more. The most important crops are peas, potatoes, tomatoes, cucumbers, and summer squash. A large part of the vegetable business is done between Haywards and Elmhurst, although a great many tomatoes are grown in other parts of the county, including the Livermore Valley. In former times the vegetable business was largely in the hands of the Portuguese and Italians, who conducted it in a small way, on account of lack of capital, but the wealthier American farmers have now taken it up in a wholesale fashion, since they find that it pays better even than fruit. A crop can be obtained the first year after planting, while it takes five years to secure a producing orchard. A great many vegetables are also grown between the rows of trees.

The tomato region of Alameda County extends along the bay shore from Mount Eden to Elmhurst, and the tomatoes produced in this region are preferred by the canners to the Sacramento River article, because they contain more substance and not so much waste; but tomatoes are also grown in other parts of the county. Some of the tomato fields of Alameda County are very large, tracts of 100 acres not being uncommon. The time of the tomato harvest is between the 10th of August and the end of October, although frequently the crop is practically all in before the 1st of October. To secure the best land, if he is farming on rented land, the tomato-grower must pay from $16 to $20 an acre, while a fair price for the product is $7.50 per ton, and the yield is about twelve tons to the acre. A large grower will ship three carloads, twenty tons to a car, each night. Frequently seventy or eighty pickers will be employed on a single ranch.

The potato crop is one of increasing importance, since it has been found that there is good money in producing the big Burbank potatoes and other commercial varieties. The best soil will produce from 75 to 80 sacks to the acre, although in former times record yields of 150 sacks to the acre were produced.

The growing of peas for canning purposes has assumed importance within a comparatively recent period, which is due to the circumstance that the canning syndicate, which operates on the plan of specialties, putting up in each of its canneries the products which are grown best in that particular locality, has made this the pea-canning center. As giving an idea of the importance it has assumed it may be mentioned that when the San Leandro factory was visited recently it was canning peas at the rate of 1,200 cases per day. Each case contains twenty-four cans, and this makes a daily pack of 28,800 cans; as the season lasts about thirty days many hundred thousand cans are put up before operations are stopped. This same cannery put up last year a tomato pack of 67,000 cases.

One of the prosperous agricultural industries of Alameda County is the growing of rhubarb for the California and Eastern markets. Until a comparatively recent date the local market was the only one supplied, but about seven years ago experimental shipments were made to the East, and since then this branch of the business, after various ups and downs, has become an important one, with a large increase in the acreage as a consequence. At the present time 500 acres of the best land the sun shines on are devoted to the cultivation of the rhubarb plant. San Leandro is the center of the industry, and it is there that success in the business of Eastern shipping has been worked out. During last spring the shipments of rhubarb to markets beyond the mountains, or to be specific, to Chicago—since that is the only rhubarb market which is a paying one up this time—were more profitable than in any former year, and as a consequence about 200 acres have been added to the area formerly cultivated. Twenty carloads were shipped this year, each car containing 560 boxes. The boxes weighed about 42 pounds each, and the shippers received a profit of something over $1 per box, net. The San Francisco shipments, although larger in amount, were not quite so profitable; but the home and foreign shipments taken together averaged a net return of a dollar. The shipments to San Francisco are about fifty carloads a year. It is a rather remarkable circumstance that the San Francisco markets appear able to stand a carload per day, while one carload in two or three days in the East is as much as the markets will absorb. When the plant sells at such a rate that it will net $1 per box, the profits are large. It will pay 10 per cent interest on land worth $1,000 per acre. The vegetable land around San Leandro is not worth quite $1,000 per acre, but it has sold as high as $700, and recently $500 per acre has been refused by owners of choice land.

The E. B. & A. L. Stone Company have leased 100 acres near Mills College for the establishment of a rhubarb farm. The company proposes to set out 500,000 plants at a cost of 5 cents each, or a total of $25,000. If the experiment is successful, the Stone Company, it is said, will farm 1,000 acres of rhubarb next season.

HOP FIELDS.

The hop industry is chiefly located near Pleasanton, and during the picking season employment is given to some 2,000 pickers.

The product of the Pleasanton hop fields for several seasons has been purchased by Guinness, the London brewer and manufacturer of a pale ale, exported to all parts of the world. Pleasanton hops command a premium in the London market, and there has been inquiry for the same from Australia. Last year one entire train was made up of cars laden with Pleasanton hops, which were placarded and sent East, and attracted much attention in passing through the country. While a largely-augmented force of employés is required during the hop-picking season, the cultivation of hops and the various other products on the ranches in the vicinity of Pleasanton require the services of a large number of employés throughout the year, and is a source of large revenue to the prosperous town of Pleasanton.

SUGAR-BEET INDUSTRY.

Sugar-beet culture is one of the important industries of Murray township. The establishment of the factory of the Alameda Sugar Company at Alvarado made it possible for this branch of agriculture to be carried on here, and, in fact, in all sections of the county adapted to beet-growing, at a fine profit to the producer. The plant of the Alameda Company is as well equipped as any in the State. It has a capacity of 850 tons of beets daily, producing in sugar about one tenth of that amount. During the beet season some 200 hands are employed. The mill originally had a daily capacity of but 350 tons, but the industry grew to such an extent that the company found it necessary to increase its plant. Extensive improvements were made last year. New buildings were constructed and machinery added to bring the factory up to the present capacity.

This year the factory is manufacturing into sugar the product of 6,000 acres of beets. The price paid is $4.50 a ton, delivered at the mill. Next year the price will be $4.75. The secret of successful beet-growing is deep plowing. This is said to be the reason why the tonnage per acre at Pleasanton, where the soil is plowed to a depth of from 14 to 16 inches, is nearly double that of other localities.

GRAPE-GROWING AND WINE-MAKING.

While Alameda is not usually classed as a viticultural county, still it has about 4,000 acres of vines, and some of the best wine in the State is made here. The Livermore Valley and the hilly region adjacent have come to be recognized by experts as perhaps the very best district of California for the production of high-class wines, or if there is any rival to this region it is found only in the hill lands of Napa County.

Alameda County did not share in early booms, since before Livermore vineyards became productive, reverses had overtaken the wine-makers and these high prices have never since been repeated. Following the general decline in the vineyards, owing to the low prices of wine, there came the phylloxera pest, which ravaged the principal vine districts of the State, and for a time the entire industry lay under the shadow of misfortune. When the revival began, about five years ago, Alameda County enjoyed her share of the new prosperity, and to-day first-class vineyard property commands from $200 to $300 per acre, with an upward tendency.

Of the estimated acreage of 4,000 acres in this county, about 3,000 acres are in the Livermore and Pleasanton districts, situated in Murray township, and the other 1,000 acres in Washington township. Outside of these two townships the area devoted to grapes is merely nominal. Practically all the vines in the county are of the wine-producing varieties, there being not more than 100 acres of table grapes. Wine vineyards are the more profitable.

The majority of these vineyards are planted to those varieties of grapes which produce the highest type of wine, and as a consequence the yield is much smaller than would be secured from more common varieties. From two to three tons per acre may be set down as the average yield of the best varieties. On the hill slopes, where the choicest grapes are grown, a yield of two tons or even of one and one half tons per acre is considered satisfactory. The deeper valley soils produce a larger crop, but the wine is not so fine. Even where only two tons per acre are produced the profit is fair if the grapes can be sold at $25 or $30 per ton. This year the prices are the highest ever paid in this county, running as high as $35 for the best grapes; nothing will be sold for less than $20 per ton.

In the Livermore district the wine industry is really only in its infancy, since the vintage has never amounted to as much as 1,000,000 gallons in any one year. The area in vines is but a small fraction of what it will be some day, for there are thousands and thousands of acres of land just as good as any which is now utilized. The present vineyards, being practically all on resistant stock, are permanent, and from this time forward there will be no backward step. A large portion of the area in vineyards in Washington township has been affected by phylloxera, but all the new vineyards are of resistant stock and that misfortune will not occur again.

SALT PRODUCTION.

The average annual output of salt recovered from San Francisco Bay, in Alameda County, for the past ten years has been about 70,000 to 80,000 tons, including both coarse and fine salt, varying according to the length of the seasons. The recovery of salt by solar evaporation in this county was begun in 1857, but did not become an important industry until in the seventies. Since that time it has steadily grown until at present the evaporating vats and refineries extend for about fifteen miles along the bay shore from Newark to Russell station; the available salt lands covering about 8,000 acres. Including clerical help and teamsters, the industry employs about 500 men.

In the past ten years the market has gradually extended beyond the local demand, until Central and Northern California, the Hawaiian Islands, Washington, Oregon, British Columbia, and Siberia were included. With the extension of the markets the Alameda County producers were met by foreign and Utah competition. The markets formerly included Arizona and that section of the southwest, but the salt from the salt-beds at Salton in Southern California and from the Great Salt Lake in Utah has about crowded Alameda salt out of that market.

These markets now consume about 115,000 tons of coarse and fine salt annually; the outside producers furnishing from 35,000 to 40,000 tons of that amount. But the Alameda County makers are each year improving the quality of fine salt; and a local authority on salt production gives it as his opinion that within the next two years this county will control and supply these markets entirely, with the possible exception of Siberia.

The salt recovered from San Francisco Bay has a lime basis, and produces a better quality of fine salt than that recovered from the Great Salt Lake in Utah, which has a soda basis. Alameda County salt has been tested and proven to be adapted to the manufacture of muriatic acid, caustic soda, soda crystals, hyposulphide, glauber salts, sodium sulphide, chloride of lime, and soda ash. So that it is within reasonable probability, considering the improvements contemplated by salt refiners, that these by-products will soon become a part of this growing industry. A market for these by-products will be found just as the market for salt has been ; and whatever other effect the trust may have upon the industry it is not likely to stay the progress of it, so far as concerns Alameda County.

STOCK-RAISING AND DAIRYING.

Though Alameda is not properly a stock-raising county, it has a large quantity of fine stock and makes much fine butter. The condition of this industry shows how advantageous is diversified farming, and how all the resources of the land and situation are utilized.

On the lands unsuited to fruit in this district the dairy industry is becoming more and more important. There is a good deal of hilly land where fruit trees can not be cultivated with profit. Formerly the best done with this was hay, and at $7 to $8 a ton there was little for the farmer in this kind of farming. People have just begun to learn that they can double their sources of profit by turning the hay into milk, and the dairy industry has had a steady growth. In Haywards itself this has been stimulated by the establishment of a creamery. Judging from the promises made to the management the number of cattle in the tributary country will be doubled in the next year. Farmers in this district, who have kept careful account of their returns through a number of years, say that a cow will return between $45 and $105 gross a year. On irrigated land one cow is kept to the acre; on unirrigated one to about two and a half acres, the proportion varying with the land. The near market offered by San Francisco and the bay cities operates here as elsewhere to great advantage.

The poultry interests of the county are very extensive. All classes thrive well. The county has many advantages for the raising of poultry, among others being the nearness to the two large markets of Oakland and San Francisco. It is estimated that the returns from this industry alone amount to about $1,000,000 per annum.

MANUFACTORIES.

The manufactories of Alameda County comprise, outside of Oakland, the county seat, extensive canneries at Haywards; an oil refinery and pottery at Alameda; iron works and furniture factory at West Berkeley; car factory at Newark; sugar refinery and salt works at Alvarado; wineries at Irvington, Mission San José, Warm Springs, and Livermore; agricultural machinery and traction engines at San Leandro; brickyards at Livermore; and a great number of minor establishments of other kinds at other points.

ALPINE COUNTY.

Alpine County is one of the mountain counties of California, and its principal industries are mining and lumbering. It has but a small population, the last census placing it at 509. Its geographical boundaries are, north the State of Nevada, east Mono, south Tuolumne, and west El Dorado, Amador, and Calaveras counties. Its area is 882 square miles, or 535,000 acres. Its cultivated lands will reach 5,000 acres.

The county is a succession of mountain ranges, with high and precipitous peaks, interspersed with numerous lakes, rivers, creeks, and beautiful valleys. Silver Mountain is one of the highest peaks in the county, having an altitude of 10,000 feet. The town of Silver Mountain is situated at or near the base of this mountain. Round Top is another one of Alpine's towering peaks; it is 10,600 feet high. There are numerous small lakes throughout the county, the waters of which are clear and cold. Many of them contain mountain trout. Of these are Blue Lakes and Caples Lakes, in the western part of the county. The county is bountifully supplied with brooks, creeks, rivulets, and rivers, many of them heading up in the mountains, fed by the numerous lakes and the melting snow, which keep them running through the summer season. The Carson River heads in the southern part of the county, and flows from south to north through the county. It is fed by numerous streams, viz., the East Fork of Carson River, the West Fork of Carson River, and Woolb, Silver, Monitor, Smith, Mogul, and Indian creeks.

Among the mountains are numerous valleys. The largest and most noted are: Diamond, Hermit, Pleasant, Hope, Faith, and Charity. Diamond Valley lies in the northeastern part of the county, and contains some very rich, productive ranches, producing wheat, barley, hay, oats, and potatoes. The three sister valleys of the county—Faith, Hope, and Charity—are located in the northwestern part, at an altitude of 7,500 feet above sea-level. These valleys are inhabited only during the summer months, and then by stock-raisers and dairymen. The dairy interest in these three valleys is of considerable importance, and more than 50,000 pounds of butter of excellent quality is produced annually. Pleasant Valley is near the town of Markleeville, where considerable hay is cut and marketed to the residents thereabouts. There are many other small valleys throughout different parts of the county, where sheep and cattle are grazed during the summer season. The nutritious bunch grass, which grows so luxuriantly in those mountainous regions, is of an excellent quality, and stock fattens very rapidly upon it.

The entire western section of the county is a wild, mountainous region, whose grandeur of scenery vies with the Alpine regions of Europe. From November until late in June the region is wrapped in a mantle of snow, varying in depth from two to fifty feet; during the remainder of the year it forms a vast mountain pasture for thousands of sheep and cattle that are driven there from the lowlands of the State to feed during summer and fall. The greater part of the surface of this mountainous region, as well as of the lower and eastern section of the county, is covered with forests of heavy and valuable timber. All the coniferous trees common to the western slope grow to a large size on all the mountain sides. When the Comstock mines in Nevada were in their zenith the wood and lumber business of the county was quite an important factor in its activity, but since the decline of the mines there this branch of business has been greatly crippled; yet now there is cut annually 750,000 feet of lumber.

In the northeastern part of the county farming is carried on to a considerable extent. Upper Carson, Diamond, and Dutch valleys are the chief seats of this industry. In the elevated valleys among the mountains, summer dairying is an important industry.

The many beautiful lakes high up among the mountains are favorite summer resorts. The Blue Lakes, especially, are becoming a famous rendezvous for summer pleasure-seekers. In many parts of the county are mineral springs, both hot and cold.

The climate of Alpine County is, as its name and topography would indicate, decidedly alpine in character. With its western boundary in the high Sierras, and its whole area in the mountains, its winters are long and rigorous, and its snowfall heavy.

In the valleys the soil is a heavy alluvium, very rich and fertile and yielding heavy crops where properly cultivated. But little fruit is grown in this county. Some very excellent apples and pears are produced, but owing to remoteness from market, and lack of transportation facilities, little finds its way into the market, the entire output being used for home consumption.

Markleeville, the county seat, is located on the west bank of Carson River, and reached by stage via Reno and Carson. It has one newspaper, hotels, stores, and dwellings. Other towns are Monitor and Silver Mountain.

There are at least twenty irrigation ditches in operation in the county, and their value is estimated to be from $15,000 to $20,000. Some have no name, a good many are not assessed, and the assessed value, where given, is about one third the real value. The Blue Lakes Water Company has four large reservoirs in the western part of the county. These are of great value and constitute an important part of the plant of the Standard Electric Company. The Union Water Company has two large valuable reservoirs in the southern part of the county, from which the Utica Mining Company at Angels, Calaveras County, gets its water. Two companies of Carson Valley farmers own and control at least twenty valuable reservoir sites in the central part of the county, upon eleven of which more or less work has been done in the construction of dams and in which water has been stored and utilized.

The mining industry, so long dormant here, is now giving promise of large results in the very near future.

AMADOR COUNTY.

Amador County is located between the Cosumnes and Mokelumne rivers, and extends from the San Joaquin and Sacramento valleys on the west to the summit of the Sierra Nevada Mountains on the east—a distance of more than 75 miles. Its altitude ranges from 300 feet above sea-level in the western portion to something over 9,000 feet in the eastern end of the county; therefore, it is blessed with a climate that should satisfy either the pleasure-seeker, the woodman with his ax, the miner with his pick and shovel, or the farmer with his plow and hoe.

The resources of Amador County are many and varied. For many years it stood as one of the leading gold-producing counties of the State, and even at the present time it has perhaps the greatest number of dividend-paying mines (quartz mining being specially referred to). Copper is also mined in considerable quantities, with many favorable prospects yet undeveloped. The western portion of the county is underlaid with immense beds of soft or fuel coal, many thousands of tons having already been shipped to different parts of the State. Many other sources of undeveloped wealth lie at its door, only awaiting the combined efforts of labor and capital to make this one of the most prosperous counties in the State. Particular attention is called to the unlimited beds of the finest potter's clay that can be produced on the coast, being right alongside of the railroad. There are many other sources of wealth, such as fine building-stone, roofing slate, and beautiful marble, of which more could be said were it not for occupying too much space.

The western portion of the county is composed of rolling hills, interspersed here and there with beautiful little valleys, the land of which is adapted to any and all kinds of agricultural products, such as wheat, barley, oats, corn, potatoes, broomcorn, and alfalfa. All kinds of garden vegetables grow in profusion, when given a reasonable amount of care. The rolling lands, which constitute the greater portion of the county, are composed principally of a gravelly, or red loam, soil, and are covered more or less with oak timber, an undergrowth of brush, and wild grasses, which make them well adapted for the raising of stock, which is one of the leading industries of the county. Horses, mules, sheep, hogs, and cattle are raised in considerable numbers, especially cattle, of which many fine herds are owned in the western portion of the county, where they are kept during the fall, winter, and spring months without other feed than that which they glean from the natural products of the soil. In summer they are driven high up near the summit of the Sierra Nevadas, there to graze along the mountain sides, just below the rim of the melting snow.

Dairying is another industry that must not be overlooked. Ione, in the western part of the county, and at the railroad terminus, boasts of having the leading creamery in this part of the State, turning out daily hundreds of pounds of beautiful yellow butter, which commands the highest market prices. Ione also boasts of having the leading flouring-mill in this part of the State, with a capacity of 100 barrels of flour per day, furnishing a home market for the farmer's grain.

Poultry-raising is an industry that is carried on to a limited extent, and at remunerative prices. Chickens range in prices from $3 to $5 per dozen; turkeys, from 12 to 18 cents per pound; eggs, in winter months, from 25 to 35 cents per dozen, and in summer months from 15 to 25 cents per dozen.

Fruit-growing, which, it might be said, is just in its infancy, is carried on in all its branches. While there is as yet but few large orchards and vineyards in this county, nevertheless it has been demonstrated that the climate and soil of Amador County are equal to any in the State for the growing of apples, peaches, pears, plums, prunes, quinces, berries in great variety, and grapes in particular. Oranges grow to perfection; as yet the quantity is limited, but the quality is unsurpassed. The olive is another fruit that has been experimented with in the foothills to a sufficient degree to prove its absolute success, and in the near future its value will become more fully appreciated and its cultivation a stepping-stone to wealth and prosperity.

The central portion of Amador County is covered with great forests of pine, spruce, fir, and hemlock timber, in which are located some extensive lumber plants that employ scores of laborers in the cutting and hauling of lumber to supply the mines that are situated twenty-five miles below.

One other valuable enterprise that Amador County may well be proud of is the plant of the Standard Electric Power Company. It is located about seven miles east of the town of Jackson, and is destined to furnish power and light not only for Amador County, but also for the City of San Francisco and intermediate points. The plant, which represents a cost of something like $6,000,000, is to be run entirely by water power, the supply coming from the never-ceasing streams and melting snowbanks up near the summit of the Sierra Nevada Mountains, the water being caught and retained in immense reservoirs until needed.

Amador County is almost invariably blessed with its share of rainfall, the average precipitation being about 23 inches; hence its farmers have not found it necessary as yet to adopt a general system of irrigation, although the supply of water would be ample, and to spare, if it were properly husbanded in large reservoirs, for which there are many available sites.

Prices of land have a very wide range, governed largely by quality of the soil and location, and also by the amount and character of the improvements thereon. Alfalfa land, or land that is already in a high state of cultivation, is held at from $100 to $300 per acre; yet there are thousands of acres of land, at present only used for grazing purposes, and well adapted to the growing of grapes, olives, figs, oranges, etc., that can be had for from $5 to $40 per acre.

Amador County had the honor, in the year 1889, when she made her first exhibit at the State Fair, of being awarded the first prize for the best county display and quality of products. One of the leading horticulturists of the county, Mr. George Woolsey, was awarded the gold medal for the best individual display, which speaks well for the resources of the county.

The climate varies with the topography, in the lower portions being similar to that of the Sacramento Valley—summer days usually warm, sometimes hot, tempered down by afternoon breezes, and cool at night. The winters are pleasant, with frosty mornings, similar to those of Sacramento, though with more bracing and clearer air, owing to greater altitude. The highest altitudes are cool and spring-like in summer, and decidedly cold in winter, with biting frosts and heavy snowfalls. Average annual rainfail at Jackson for ten years, 31.81 inches; average annual rainfall at Ione for ten years, 19.63 inches. The difference is due to difference in elevation and topography.

The production of hay, grain, alfalfa, and vegetables is naturally limited to the demands of home consumption. Where suitable soils are selected, however, the yield is large.

The Foothill Experiment Station of the State University is located in this county, 5 miles from Jackson, on the Amador ditch. It contains 36 acres, and is devoted to testing the adaptation of soils and location to the various fruit trees and vines, deciduous and citrus.

BUTTE COUNTY.

Butte County, which is one of the chief agricultural and horticultural counties of the State, occupies a position in the northeast portion of the Sacramento Valley; it is bounded on the west by the Sacramento River, and on the east by the summit of the westerly range of the Sierra Nevada Mountains. Its total area is approximately 1,730 square miles, or somewhat larger than the State of Rhode Island. One half of the whole may be properly termed foothill lands, and of the remainder one fifth may be dominated as mountainous, leaving about one third of the entire area as fertile valley or agricultural lands. The mountains are heavily timbered, giving place to important lumbering interests; the foothills are covered with oak and smaller growth, while the valley lands have, with the exception of the adobe soil, splendid growths of mammoth oaks.

The county is so situated that it has all the advantages of cheap and ready transportation. The Sacramento River, along its western boundary, affords communication by water for the passage of vessels at all times of the year, while the California & Oregon Railroad traverses the center of the county its entire length; a branch of the same line extends to Oroville from Marysville; thus giving all the more important parts of the county ready communication with the markets of the coast and the seaport at San Francisco.

PRINCIPAL TOWNS.

The principal towns of Butte County are Chico, Oroville, Gridley, Biggs, and smaller villages and hamlets in valley and mountains.

Chico is the metropolis, and is on the California & Oregon Railroad, in a rich agricultural and horticultural section. It is an incorporated city, with a full corps of municipal officers, and has a population, with suburbs, of fully 5,000. It is the educational center of the northern half of the State, being the location of a State Normal School, possessing a splendid building, thoroughly equipped, and with over a score of instructors, and between four and five hundred pupils in regular attendance. The public schools consist of three buildings, with another to be erected this year, and sixteen instructors. A high school will be formed this spring, the necessary steps having already been taken. Chico has wide, tree-lined avenues, lighted every night of the year, purest water, piped to every door, and a complete sewer system now being constructed, for which $45,000 in bonds were recently voted. It has intelligent, progressive people, and is a growing city and a desirable place in which to establish a home. Nine or ten church denominations are represented.

Oroville is the county seat, and is situated at the terminus of the Northern California Railroad, running from Marysville, 28 miles distant. It is a prosperous, growing place of 2,500 people. It has a union high school with three instructors, and public schools with seven teachers. There are numerous churches. Light and water works furnish those necessities. Oroville is the center of the orange-growing district, and is besides the leading mining town of the county. The great dredger mining industry near there, which will continue for many years to come, is the means of distributing much money there, and the town is growing rapidly. Every dooryard is an orange grove, and its people hospitable and anxious to show to newcomers that section's advantages.

Biggs and Gridley are on the California & Oregon Railroad in the valley proper, and in the midst of fertile farms and great orchards. Both have excellent public school facilities, and the latter a union high school. Their population is about 1,000 each. Both have several churches and are growing towns, which with a proper development of their resources, will go forward into cities.

CLIMATE.

The climate of the county is similar to that of all the interior parts of California, with the exception that its situation near the Sierra Nevada Mountains induces a more abundant rainfall than have many of the other interior counties, thus rendering a failure of crops practically unknown, and reducing the expense of farming and fruit-growing to a minimum, because of the absence of irrigation requirements. In the higher parts of the county during the winter months some snow falls—just enough to insure to the numerous streams crossing its area living water during the long summers. In the foothills the climate is more delightful, no snow falls and frost comes but seldom. Warm summer days are tempered by cool nights, and everything is propitious for the luxuriant growth of all plant life. In the valley the climate is but a modification of that of the foothills, long rainless summers giving opportunity for the garnering of grain and the curing of fruit. In September the rains begin, and from then until May are of frequent occurrence, so interspersed with faultless, spring-like days as to give to all vegetation the moisture needed and not so plentiful that damage accrues. Frosts come infrequently; and until the rainless summer begins, hill and dale are covered with verdure, giving sustenance to the herds of sheep and cattle that find grazing places and their sole feed thereon. As before stated, the rainfall is abundant and a "dry" year is unknown. It varies from about an average of 25 inches per annum in the valley to considerably more in the foothills and mountains.

WATER-SUPPLY.

Irrigation is not generally practiced in the growing of fruit or grain, except citrus fruits; but should it be deemed advisable in the future, no county in the State possesses the natural facilities that Butte does. The great Sacramento River runs along its western boundary, while in the eastern section the Feather River bisects the county, with enough water to irrigate the whole of the lands that are adapted to fruit; Butte Creek, another large stream, runs through its center, while Big Chico, Pine, Mud, and numerous smaller, but never-failing, creeks run through thousands of acres of its most fertile lands. But without these supplies nature has provided in the valley portions immense subterranean reservoirs, easily accessible by shallow wells of from 12 to 20 feet, which countless pumps can never exhaust or lower. With cheap power, which the county now in a measure possesses (it being traversed by several electric power lines), the irrigation of all its lands adapted to fruit, stock, or garden is not a problem of any consequence. In the eastern section of the county, where orange and olive growing has now assumed great proportions, irrigation is generally practiced, and a shortage of water-supply is never known. Many of the irrigating canals were originally constructed for mining purposes, but with the passing of the necessity for such use they have been converted into means for cheaply irrigating the lands. According to the Assessor's reports there are within the county the following ditch properties, with mileage:

	Miles.
South Feather Water and Union Mining Company	42
Palermo Land and Water Company	44
Cherokee Mining Company	50
Oroville Water Company	33
Private ditches	125
Total	294

THE SOIL.

The soil of the county varies with location. In the hill section it is mostly of a red, gravelly quality, which experience has shown is best adapted to citrus fruits and olives; in the valley proper it is divided into three qualities: adobe, which is solely devoted to grain, and which in favorable seasons produces immense crops; the bottom lands along the creeks and rivers, where garden and fruit and grain all do well; and the black loam lands which prevail about Chico, unequaled for fruit and grain. In the county there is scarcely a foot of land which, if properly worked, can not be made to produce abundantly of some marketable product. Even in the mountains are many little valleys where hay and grain and fruit and stock provide plentiful livings for families who work their lands to the best advantage.

AGRICULTURE.

The products of Butte County are many and varied, ranging from the orange, lemon, and olive of the semi-tropics, to the apple and fruit and grain of more northern climes. To these direct products of the soil must be added the great stock interests, also the mills which convert the timber of the hills into lumber which finds its way all over the West. In the valley portions grain-growing has been, since the settlement of the county, one of the chief, and for many years was almost the sole, product grown. Tens of thousands of acres are yet devoted to this industry, and in wheat, barley, and hay, Butte is one of the foremost counties of the State. As stated above, climatic conditions and rainfall are such that a failure of crops is practically unknown. Conditions may arise occasionally which make a shortage, but a total loss is unheard of.

The vast expanse of country reaching from Chico, Dayton, Nord, and Durham on the north, past Nelson, Biggs, and Gridley to the county line on the south, and from the edge of the foothills on the east to the

Sacramento River on the west, is as fertile and beautiful a body of land as the sun shines on, in a measure farmed, but capable of supporting ten times its present population. This is the great grain-growing section of the county, though much of its territory has in later years been turned from wheat fields into orchards. Much of this land never sees a human being but twice a year—once at plowing and seeding time and again at harvest. The immensity of the holdings prevents thorough working, though happily the cutting-up of the large ranches has commenced, and the tendency of the times to smaller holdings has been inaugurated in Butte County. The average output of grain—wheat and barley—is estimated to be from 35,000 to 40,000 tons annually. It is impossible to arrive at the exact figures, but they will not vary much from the foregoing. The most of this goes out of the county by rail and water to all parts of the world. A large supply of the barley is fed to stock at home, and much of the wheat is converted into flour in the three mills within the county—at Chico, Oroville, and Durham. For the current year there is a somewhat increased acreage sown. The growing of hay is another important industry to be found within the section named, and many hundreds of carloads are annually shipped from the county, besides that used for home consumption. Grain- and hay-producing will, for many years to come, be one of the principal industries of the county, and to which thousands of acres will be devoted, despite the tendency in some localities to subdivide the lands.

HORTICULTURE.

Butte County in fruit production has reached that stage where it is to be classed as among the first in the State. According to the Assessor's report for the year 1901 there are nearly one million bearing fruit trees within the county, besides probably a third more to be classed as non-bearing. The Assessor states that these figures are in a great measure unreliable, in that owners of lands fail to turn in the proper number, and that the figures are far too low. According to the report, however, there are within the county the following trees:

Apple	8,175	Pear	20,425
Apricot	14,450	Prune (French)	75,200
Cherry	9,600	Prune (other kinds)	8,115
Fig	9,320	Orange	307,800
Olive	71,000	Almond	25,375
Peach	125,000	Walnut	965

The four most important kinds, as will be noticed, are the orange, the peach, the prune, and the olive.

The Peach.—The natural home of the peach is in the rich valley lands about Chico, Durham, Biggs, and Gridley, with other important orchards in the vicinity of Oroville and in the adjacent foothills. The Rancho Chico orchards at Chico and the immense orchards at Rio Bonito and elsewhere along the Feather River constitute the largest single holdings devoted to this fruit in the county, and at least two of these plantings rank among the largest in the world. Butte County is essentially the home of the peach, and during the harvest season hundreds find employment in the orchards, drying-yards, and canneries. The quality of the fruit is of the best, and in years of average yield a peach orchard is a handsome source of profit to the owner. It is largely to this fruit that the owners of small tracts in the sections of the county named have and are planting their lands. Planting of this fruit during the current year promises to be largely increased, and each succeeding year for many years to come will doubtless witness an increased acreage.

The Orange.—In orange-growing, Butte County occupies a unique position among the counties of the State. Geographically it is classed as one of the northern of the State, and yet climatic conditions are such that it is fast forging to the front as one of the chief of the orange-growing counties. The chief orange-growing sections are about Oroville, Palermo, and Thermalito, along the edge of the foothills, though the fruit does well in all parts of the county, and is successfully grown at Biggs, Gridley, and Chico, and in all valley parts. Strange as it may appear, Butte County annually sends large quantities of oranges to Los Angeles, for the reason that the fruit here ripens from six weeks to two months earlier than in the southern counties, and before the holiday season it is practically all disposed of, thus being first on the local and Eastern markets and netting shippers the highest prices paid during the year. Los Angeles, even, has to send to Butte County for its Thanksgiving oranges The fruit is clean, free from smut or rust, and there is a never-failing supply of water for irrigation. There are large packing-houses at Oroville, Palermo, and Thermalito, and competition among buyers is keen long before the season opens. Most of the fruit of course goes to the East. Planting is still going steadily on, for it has been demonstrated beyond any doubt that large profits accrue to the grower and that by reason of its early ripening the Butte County orange does not come in competition with the sections of the State where the largest production is had. For the intending settler, this industry offers and will continue to offer unexcelled opportunities.

The Olive.—Olive-growing is also an assured success, and as time goes on and the large acreage comes into full bearing it will be among the county's first industries. The olive seems to do equally as well in almost all parts of the county. At Chico there is a large acreage in the fruit, and at Palermo, Oroville, and Thermalito are immense orchards. At all of these places there are olive-oil mills and pickling plants, which annually turn out products which have achieved a wide reputation for excellence, and the demand seems to be greater than the supply. Pure olive oil and ripe pickled olives, manufactured from fruit grown in the county, are now shipped all over the United States.

The Prune.—Prune-packing from the large orchards devoted to this fruit in the vicinity of the line of railroad, and especially at Chico, Durham, Biggs, and Gridley, has assumed mammoth proportions. There is a coöperative prune warehouse at Chico, where is stored and from whence is shipped the principal product in this line. The fruit is heavy in sugar, of the best marketable size, and affords handsome incomes to the many growers.

About Paradise, Pentz, Wyandotte, and Bangor in the foothills, are many fine orchards, of these and other varieties, and there are ample opportunities for all those who may contemplate engaging in such industries at all points in the county.

Other Fruits.—Mention should be made of the excellent apples produced in the foothills and mountains of the county; the several thousand fig trees, which seem to find a natural home here; and the great yearly output of apricots, cherries, pears, and almond and other nut crops.

Fruit Shipments.—In the spring of 1901 conditions were such that there was a very large shortage in the fruit crop (except oranges and olives), so that a report of the shipments of green and dried fruit from the county for that year would not do justice to the county. The average for the past five years would give a better understanding of the great importance of the fruit crops of the county, and for that reason the figures below are intended to convey that information:

	Cars.
Cured prunes	225
Cured peaches	250
Cured apricots	30
Cured pears	32
Cured apples	15
Almonds	40
Oranges	400
Table grapes	25
Green fruits (miscellaneous)	175

To the above must be added the miscellaneous shipments of olives and olive products (aggregating many cars), small fruits and berries, which go largely in less than carload lots, the large quantities sent to the neighboring mining towns by wagon, and the home consumption. But other than this there are several hundred carloads of green fruits that are packed at the canneries at Chico and Gridley. These canneries are important factors in the county's prosperity, affording a home market for the fruit grown, and giving employment to many hundred men, women, and girls during the summer months. Thus the small grower has a market for his products at his door, and employment for his family during the years before his orchard is in bearing. The mining camps in Butte and adjacent counties are an important market also, and large quantities of fresh and dried fruits are consumed therein each year.

VINEYARDS—HEMP-GROWING.

The planting of vineyards during the past year has received a hearty impetus, owing to the demand for wine grapes and the adaptability of the soil of the county to vines. This has been especially noticeable in the vicinity of Gridley, where quite a large acreage has been set to vines.

Hemp-growing in that vicinity is also an important and growing industry, and numerous cars of the fiber were shipped during the past year to Eastern factories. The fiber is described as being of high-grade, and there are opportunities along the river bottoms for future developments along this line.

DAIRYING—POULTRY-RAISING.

Dairying has never received the attention in this county that its importance and the adaptability of the soil and climate warrant. There are creameries at Chico, Biggs, and Oroville, but the two former were only operated during a portion of last year. They are now under lease, however, with the promise that during the present year careful attention will be given to their operation. Numerous private dairies in various parts of the county attest the value of the dairy herd, however, and with the cutting-up of the larger ranches there is certain to be more attention paid to this industry. Alfalfa can be and is grown with great success, and many are turning their attention to this crop, with the result that the dairying interests will benefit thereby.

There is a steadily growing interest in the raising of poultry. During the past year, particularly in the valley sections of the county, many land-owners have turned their attention to the raising of chickens, turkeys, and ducks, principally the former. Near Nelson, Mr. Joel Nelson, a farmer of many years' successful experience, has established poultry yards on an immense scale, with every present indication of success. About Chico numerous small land-owners have gone into the business, and their success will doubtless encourage others during the year to enter the same line. The climate, soil, and feed conditions are such, together with the ever inadequately supplied market, that the greatest inducements exist in Butte County for the further development of this industry.

LIVESTOCK INDUSTRY.

The raising of cattle, sheep, and hogs has ever been an important industry in Butte County, and during the past year numerous farmers have come to the realization that the devoting of as many acres of their lands as is possible to the pasturage of stock is an industry that pays better than grain-growing. The foothills and mountains afford, during the summer season, abundant grazing grounds, while in the other seasons the low lands and stubble fields of the valley fatten for market many cattle and sheep. Many cars of cattle, sheep, and hogs are shipped each year from the county to outside markets, and many hundred head are driven in from the ranges in the north end of the State to be fattened for market. Stockmen are gradually improving their breeds by the introduction of better stock, and the high prices obtained have placed this industry among the most prosperous of all the varied ones of the county. The tendency is toward a reduction of the large herds owned by a few to the general ownership by the many of a few head, or as many as their lands will support. This tendency will result, in the near future, in more stock in the aggregate and of better breeds.

Large bands of cattle and sheep are herded during the summer in the mountains and in the rich mountain meadows, which are well watered and are clothed with rich natural grasses. A large amount of timothy hay is raised in the mountain meadows of Butte, and the dairy interest is very extensive and profitable, the best of products being turned out under these favorable conditions. Much butter is made, especially in the mountains, where timothy hay and natural grasses are abundant.

THE LUMBER INDUSTRY.

The lumbering interests of the county were never in a more prosperous condition than during the past year. The mountains of the county abound in fine timber, much of it being sugar pine of the best grade. The largest company—the Sierra Lumber Company—made a phenomenal cut last year, and is preparing to increase that this year. The most of their lumber is floated by means of V flumes many miles in length to Chico; from whence it finds rail transportation to market, and is also converted into boxes and building material at their large factory in Chico. Numerous smaller mills also operated full time during the season, most of the product being hauled to Oroville and Chico by teams. During the year just closed Eastern buyers have acquired large tracts of lands in the Merrimac, Lumpkin, and other timbered sections of the county. What their object is has not been publicly stated, but there is talk of a narrow-gauge railroad from Oroville to these holdings, with a consequent means of getting the lumber to market in a cheap and rapid manner. Lumbering will continue to be for many years one of the most valued of the county's industries, affording profit to the producers and employment to many men.

OPPORTUNITIES FOR HOMESEEKERS—PRICES OF LANDS.

Opportunities in Butte County for intending settlers were never so good as now. The fruit-growing industry, both citrus and deciduous, has passed the experimental stage, and the profits are easily ascertained and assured. The county offers unexcelled chances for the man of small means with a family to acquire land in small tracts, and, while his plantings are in the non-productive stage, there is work for him and his family, either for others or in the production of poultry and small fruits and berries, sufficient to afford a handsome livelihood.

In the eastern part of the county, about Oroville, Palermo, Thermalito, and Wyandotte, and along that line of foothills, extending to Pentz and Paradise, where citrus fruit-growing is most in vogue, lands in small tracts with abundant irrigation facilities are offered for sale at prices ranging from $25 to $100 per acre, according to location and desirability. Bearing groves can also be purchased, though of course the price of these is much higher. In the rich valley sections, especially adapted to deciduous fruits, nuts, poultry, and small stock-raising, with dairying opportunities, some of the richest lands in the known world are now on the market. A large part of the John Bidwell rancho, known all over the United States for its richness of soil and beauty and healthfulness of location, has been subdivided and is now on the market. This ranch was a Spanish grant of over 20,000 acres, made before the American occupation, and until General Bidwell's death in 1900 it was held intact. Nearly 2,000 acres of it are in bearing orchards, and the balance was given up to grain and stock. Most of it is beautifully timbered with oak, and its soil is capable of producing every product known to the State. A portion of this vast estate has been subdivided into tracts of from ten acres upward, any ten acres of which will support a family in comfort. This land is listed at from $50 per acre and upward, and is meeting with ready sale to a desirable class of people. Already planting and building are going rapidly ahead on the lands. Visitors are courteously received and shown over the lands and given every opportunity to inspect their worth. Other tracts of small acreage about Chico are also on the market, and at Durham, Nelson, Biggs, and Gridley there are also opportunities to buy, in any desired tracts, lands of the highest quality.

There are excellent and unsurpassed opportunities for new settlers in Butte County. Fruit and grain growing, dairying, poultry-raising, garden and berry farming, and stock-raising are still capable of much further development. The county is great in territorial expanse and capable of supporting many times its present population. Mining and local manufactories afford work to many, and there is certain to be great advancement in these lines in the next few years. The climate is an ideal one as compared to any part of the East, and families can live in ease and comfort on much less than is required where long winters stagnate all effort for so many months in the year.

The progress of the county along all lines during the past year has been marked. More building and improvement have been done in the principal towns of the county than for a decade past. The prosperity has affected all classes, and there is every indication of a continuance during the coming year. There is room in the county for many more desirable people, and the people of the county invite visitors and a comparison of their resources and advantages.

CALAVERAS COUNTY.

Calaveras County is located almost directly east from San Francisco, from which it is distant about 130 miles. It is bounded on the north by Amador, on the east by Alpine, on the south and southeast by Tuolumne, and on the west by San Joaquin and Stanislaus counties. The county is triangular in shape, its longest side being 54 miles, and its base, resting upon San Joaquin and Stanislaus, being 32 miles. It has an area of 971 square miles, or 668,000 acres.

The topography of the western part of the county consists of rolling hills and small valleys, the hills being covered with a sparsely scattered growth of oak or pine timber. The eastern portion of the county is mountainous in character, and contains magnificent forests of sugar pine, yellow pine, spruce, fir, and cedar. In this section are found the *Sequoia gigantea*, or Big Trees. These trees are the largest and most noted in the world, being classed as one of the seven natural wonders.

The Mokelumne River extends along the whole northern boundary of the county, and tributary to this is the South Fork of the Mokelumne, with its numerous branches. Extending along the southern boundary is the Stanislaus River with its numerous small tributaries. Running through the county midway between the boundary streams is the Calaveras River, with its tributaries, the Jesus Maria, San Antone, Middle Fork, and South Fork. These streams and their branches are tapped at various points and their waters distributed through 600 miles of ditches to various parts of the county. Springs abound in all sections of the county.

CLIMATE.

From the peculiar formation and location of the county, the climate is remarkable and widely varied. Divided climatically, the western or valley portion, with an average width of 10 miles, has an mean annual temperature of from 60° to 68°. The foothill section adjoining, to a width of 32 miles, has an average temperature of from 44° to 52°. The mountainous or eastern section has heavy snowfalls in winter, but the summers are cool and delightful.

From May until October the county is without storms. From October to May abundant rain falls. The summers are similar to those of all the inland counties of California, the thermometer ranging from 80° to 100° at midday, but the nights are always cool and refreshing. There is an absence of fogs and chilling winds.

The rainfall in Calaveras is usually ample to insure good crops, the average being about 20 inches.

SOILS.

Calaveras is strictly a mining county. The great Mother Lode of the State runs through the county. West of the Mother Lode is the copper belt, extending from Copperopolis to Campo Seco. Still west of the copper belt a lead of quartz runs from Knights Ferry on the Stanislaus to a point below Campo Seco; this lead has been prospected with excellent results. There is also what is called the "East Belt," extending from West Point to Murphys.

The mining towns of the county furnish an excellent market for the farmers. There are many varieties of soil in the county. All, however, are impregnated to a greater or less extent with granite, slate, limestone particles, volcanic ash, and iron sulphides.

In the northeastern part of the county is a granite soil; following this comes the red loam of the foothills, then the sandy alluvial soil of the plains, next the black sandy loam of the bottom lands.

In the granite belt the vine and the more hardy fruits, such as the apple, pear, and plum, thrive; while on the red loamy hillsides is found excellent land for fruit and vine culture. The plains are largely given to grain and orchards. The rich river bottoms grow, without irrigation, fruits of all descriptions, together with large tracts of corn, beans, and melons.

WATER-SUPPLY.

In the southeastern portion of the county the Union Water Company's 90 miles of ditches take 10,000 inches of water from the North Fork of the Stanislaus River, at a point about 8 miles from the extreme eastern boundary. In addition, the company's reservoirs hold in store an amount of water sufficient to supply 500 inches a day for twelve months. This water is distributed around Murphys, Vallecito, Douglas Flat, Altaville, Angels Camp, and thence to Carson.

The Table Mountain ditch takes 500 inches of water from San Antone Creek and conveys it to Sheep Ranch and El Dorado.

The Clark ditch takes its water from the South Fork of the Mokelumne, near the Big Trees. It extends thence westerly over a belt of country about 32 miles long. This system can be extended to cover all the country lying below the northwestern corner.

Joining this system on the north is the West Point ditch, taking 400 inches of water from the Middle Fork of the Mokelumne River at a point 6 miles east of West Point, and conveying it thence to West Point and vicinity.

Following the Clark ditch into the valleys is the Mokelumne and Campo Seco Canal and Water Company's ditches. One ditch takes 2,000 inches of water from the South Fork of the Mokelumne River, 2½ miles northeast of Glencoe. The company's reservoir near Railroad Flat gives an additional 300 inches of water for three months. This extensive canal system covers and supplies Mokelumne Hill, Gwin Mine, Campo Seco, Valley Springs, Burson, Wallace, and Camanche.

The Ide & Terwilliger ditch takes about 500 inches of water from San Antone Creek and conveys it to El Dorado, Cave City, and Old Gulch and vicinity.

The Emery Gold Mining Company has a large reservoir 3 miles east of El Dorado.

The Salt Spring Valley reservoir, now used to supply the North Hill Mine, near Milton, furnishes a large supply of water.

The Lancha Plana and Poverty Bar ditch is at present idle.

Another new ditch system is in course of construction—that of the Calaveras Water, Mining, and Development Company. Two thousand inches of water are taken from San Antone Creek and conveyed by a system of ditches to Round Butte Mine, El Dorado, San Andreas, and vicinity. The company contemplates the erection of a large storage reservoir on San Antone Creek near the Big Trees, which will hold 200,000,000 gallons.

The San Domingo Company's ditch takes the waters of San Domingo Creek, and the company has surveyed a line to the Stanislaus River, and, next summer, intends to construct a ditch.

These ditches are used principally for mining purposes; they serve to show what can be done by a system of intelligently conducted irrigation works, supplied from storage reservoirs, for which numerous sites can be found in the county, and to supply which there is abundant water.

The county is now well furnished with electric power: that of the Standard Electrical Company on the north and west, and the Utica Electrical Company on the east and south. Many quartz mills are now run by electric power, which gives more water for irrigation purposes.

The Assessor's valuation of the water works and canals of Calaveras County is given herewith:

	Assessed Value.
Lancha Plana and Poverty Bar Water Company	$1,000
Union Water Company	110,000
Mokelumne and Campo Seco Canal Company	60,000
West Point ditch	3,600
W. V. Clark ditch	4,000
California Company's ditch and reservoir	15,500
Ide & Terwilliger ditch	1,500
Table Mountain ditch	4,500
Old Gulch ditch	1,000
San Domingo Company's ditch	18,000
Emery ditch and reservoir	3,000
Total	$222,100

CULTURAL PRODUCTS.

Calaveras produces a long list of fruits, both citrus and deciduous. It is not as a horticultural county that Calaveras is known, but a great deal of attention has been given to fruit-growing.

In the citrus belt, which embraces the western part of the county, the orange, lemon, citron, and olive are found, thriving in places with great luxuriance. Citrus fruits are not grown extensively, but where grown are a success.

At Campo Seco can be seen orange trees which are over thirty-five years old, and which continue to bear remunerative crops annually. Mrs. Creighton and C. Borger have trees of the Navel variety which are bearing as fine oranges as can be found in the State. At Jenny Lind, Burson, Poverty Bar, Valley Springs, and Mokelumne Hill oranges and lemons are grown; but owing to the fact that the water companies will not agree to furnish perpetual water for irrigation, no large tracts of citrus fruits have been planted.

Olive culture is doing well without irrigation; there being several large orchards in full bearing in the western part of the county.

In the eastern part of the county, where the rainfall is greater and the summers cooler, very fine apples and potatoes are grown. This district is known as the "apple and potato belt"; and large crops of excellent quality are annually produced, selling at good prices. Deciduous fruits, such as the apple, pear, peach, nectarine, apricot, cherry, plum, and prune, are grown in all parts of the county.

In over one half of the county the fig crop is certain and abundant every year.

For nut-bearing trees, Calaveras seems to have congenial surroundings. In Vallecito, Douglas Flat, and West Point the English walnut is grown to perfection. In the western part of the county there are several large almond orchards. The nuts grow to perfection, but the trees blossom too early, and are sometimes nipped by late frosts.

The local markets consume most of the fruit. The remainder, both dried and green, is shipped to outside markets.

Small fruits do well, but all raised is sold in local markets.

It would be hard to say what part of the county is best adapted for fruit-raising, but the largest orchards are in the western part; this is probably because it is nearest to railroad facilities.

Small orchards are found all over the county.

From the Assessor's books the following, showing the number of fruit trees in the county, is furnished:

	Bearing.	Non-Bearing.
Apple	6,000	4,000
Apricot	2,000	1,000
Cherry	500	200
Fig	400	200
Olive	6,000	1,000
Peach	4,000	1,000
Prune	1,000	300
Pear	500	100
Orange	400	300
Almond	1,000	500
Walnut	400	300

Grapes are grown to perfection, except in the extreme eastern part of the county. There are about 35 acres in raisin grapes, 100 acres in table grapes, and 1,700 acres in wine grapes. Most of the grape crop is made into wine, as the county has poor shipping facilities.

A greater part of the grain sown in the county is cut for hay, and sold locally; but considerable quantities are allowed to mature into wheat, corn, oats, and barley.

Garden truck is raised in large quantities, but is used for home consumption. The mining towns furnish an excellent market for all that is produced.

LIVESTOCK AND OTHER INDUSTRIES.

The increase in the value of cattle has stimulated this industry in the county. There are now over 20,000 head of cattle in the county, mostly in large bands. In the summer months these are driven to pastures in the high Sierras.

Some attention has been given to dairy products. Upon the ranch of Mrs. Adams, near Murphys, are to be found some of the finest dairy cattle in the State.

The increasing demand for horses for war purposes has also stimulated this industry. There are now about 3,000 horses and 500 colts in the county. Fine blooded horses are reared in several parts.

Hogs are raised in large numbers.

The sheep industry is now doing well. There are over 20,000 sheep in the county, and Calaveras wool always brings the top figure.

Angora goats are to be found in several portions of the county. They are a hardy animal, increase rapidly, and are an excellent food.

Very little lumber is shipped into the county outside of the western portion, where it is brought by rail.

There are several sawmills in the county; two near West Point, one north of El Dorado, and two near the Big Trees. These mills furnish nearly all of the lumber used.

In the northwestern part of the county is the farm of Mrs. E. A. Hill, where the pyrethrum plant is grown and buhach manufactured therefrom.

The price of land varies in the different localities, ranging from $5 to $50 per acre.

COLUSA COUNTY.

Colusa County is bounded north by Glenn, east by Sutter, south by Yolo, and west by Lake County. Area, about 1,200 square miles, or about 768,000 acres.

TOPOGRAPHY.

Of the entire area of the county, approximately one half is the Sacramento Valley, one third arable hills, and one tenth interior valleys, the balance being mountainous. A range of hills runs north and south through the county, parallel with the Coast Range, which forms the western boundary of the county. Between these is a series of smaller valleys. Stony Creek heads within 20 miles of the south boundary of the county, separated by a small divide from the waters of Cache Creek. It thence runs northerly, skirting the base of the mountains, to the northern boundary of Glenn County; then breaks through the range of low hills and flows southeasterly across the valley to the Sacramento River. Several other streams, nearly as important, heading in the Coast Range, flow through Yolo and Solano counties into the tule basin. The Sacramento River, which skirts the eastern boundary of Colusa County, runs on a slight ridge which is higher than the lands lying west of it, and the smaller streams, which only run in wet winters from the hills below, empty into the trough thus formed. This trough begins six or seven miles south of the mouth of Stony Creek, and, gradually widening, becomes a tule basin near the lower end of the county.

SOILS.

Along the river, bordering the hills, and in many of the smaller valleys, the soil is a loose, rich, sandy loam, easily worked, retaining moisture and very fertile. In some places it is adobe, a light or heavy clayey soil, producing excellent crops, but must be properly cultivated and at the right time. The foothill soil is rich, mellow, easily worked, and possesses every element of adaptation to the production, in perfection, of all fruits known to temperate or semi-tropic countries. The main valley is all alluvial, and has given Colusa County the distinction of being for years one of the banner wheat counties of the State.

CLIMATE.

The climate does not vary much from that of a great portion of the Sacramento Valley, except that the summer temperature is lower along the river bordered by timber growth than on the plains and among the foothills devoid of timber. In lower elevations the days are warm from the middle of June to the middle of September, but delightful through the remaining nine months. The dryness of the air in summer makes the nights refreshing. In winter some frosts occur. The rains in the valleys and on the foothills begin in October and continue at intervals until May. The climate of the Coast Range on the western boundary is one of the finest and most healthful in the world. The average summer temperature is 79.6°. The average winter temperature is 48.5°. The highest occasional extreme is 113° and the lowest 20° for the Sacramento Valley, taken from observations at Colusa, Princeton, Williams, Willows, Orland, and College City. The average rainfall for the same localities is 14.42 inches.

AGRICULTURE AND HORTICULTURE.

The main part of the valley is devoted to wheat production. Before the segregation of Glenn County on the north, Colusa in one year produced 7,250,000 bushels of wheat for export. Grain farming is conducted on a colossal scale. Combined harvesters, drawn by traction engines, cut a swath of forty feet; the grain, in sacks, being thrown off at the rear. The same engines, in plowing season, drag twenty-four ten-inch plows, doing in twelve hours the work of one hundred mules for the same time. The grain ranches are mostly owned in very large acreage.

All vegetables, grain, and fruits are raised without irrigation, but the Sacramento River carries sufficient water (and it can be used) to irrigate the whole Sacramento Valley. With irrigation, more than one crop of vegetables or hay can be grown in one season.

All the temperate and semi-tropic fruits grow successfully side by side in this county. There is a wide range of adaptability in the soil and climate. Prunes are a favorite crop; next peaches, pears, and apricots; also cherries, plums, nectarines, almonds, walnuts, and other nuts, olives, grapes for raisins, for table use, and for wine, and apples in the higher altitudes. Citrus fruits are also successfully grown, and although not much extensive planting has been done, they can be grown as successfully as in other sections for the purpose of profit and foreign shipment. The raisin grape thrives abundantly near College City, Colusa, and other points. The fruits of Colusa are marketed by green shipments to Sacramento and the East, by drying, and at the local canneries.

LIVESTOCK INDUSTRIES.

The dairying and poultry industries are very profitable. There are several up-to-date creameries with skimming stations located throughout the county. It is an ideal locality for these industries, and the outlook for dairying is especially excellent.

The cattle, horses, and sheep raised in Colusa County are very numerous and of fine grades, though the stock business is subordinate to and dependent on the agricultural and fruit interests. The hog product is quite large.

TIMBER AND MINING.

The scattering oak in the county along the streams and in the foothills is used for fuel. The pine, spruce, and cedar in the mountains are not so readily accessible as in other districts, nor so valuable, and have not, therefore, been much encroached upon.

This is not in general a mining county, though in the Coast Range there are deposits of gold, cinnabar, copper, and chromic iron, lying ready for future development. A good quality of limestone is also found, and a fine cement in unlimited quantities. In the southwestern part of the county there are surface indications of oil and natural gas, and near Sites salt springs are found.

PRICES OF LAND.

The prices of unimproved land in Colusa County range from $10 to $50 an acre, according to the location and fertility and nearness to rail and river transportation.

Colusa is the county seat, with a population of over 1,600. Other growing towns are Maxwell, Williams, Arbuckle, College City, and Sites. Near the last named place are located the sandstone quarries which furnished the stone used in building the new ferry building and hall of justice in San Francisco; this stone is of a very superior quality.

CONTRA COSTA COUNTY.

Contra Costa County is one of the central counties of California, its shore line being within 14 miles of San Francisco. It possesses unusually good traveling facilities, both by rail and by steamer, which fact is proven by its boundaries, which are, on the north, the San Pablo and Suisun bays, the Straits of Carquinez, and the San Joaquin River; on the east, Old River, separating it from San Joaquin County; on the south, Alameda County; and on the west, San Francisco Bay; the county having 70 miles of water-front, nearly all of which is upon deep water, navigable by all vessels engaged in commerce. Its superficial area is 695 square miles, or 439,800 acres. Over three fourths of this area is cultivated, the balance being used for grazing. The only mountain of any size in the county is Mount Diablo, which is 3,896 feet in height and almost in the geographical center of the county.

TOPOGRAPHY.

About two thirds of the area of the county is rolling and hilly. Lying between the hills are some of the most fertile and beautiful valleys of this great State, which are drained and watered by many streams, the banks of which are bordered by oak, sycamore, laurel, willow, etc., while the hills are dotted with oaks, many of which are of large size.

The farming lands in the eastern section of the county are between the foothills and the San Joaquin River. They are 23 miles in length and from 3 to 6 miles in width, and embrace about 60,000 acres of arable land. The soil is, generally speaking, of a rich alluvial nature, and produces wheat, barley, alfalfa, fruit, and vines. To the northward and between the uplands and the San Joaquin River, is a body of tule lands, embracing in all some 50,000 acres, a large portion of which has been reclaimed within the last few years, and is known as some of the most productive land in the State, being a rich deposit of sediment and decomposed vegetation. Alfalfa, asparagus, potatoes, beans, etc., are the products produced on the largest scale on such lands, asparagus being shipped East by the carload during the early spring.

CLIMATE.

The climatic effects in Contra Costa County, due to its topography and position, can very easily be traced. Its situation, lying as it does between the Golden Gate and the great San Joaquin Valley, gives it a medium climate, equally free from the fogs of the ocean and from the intense heat of the interior of California. Its mean annual temperature is from 52° to 60°, except in the extreme eastern portion, where it is from 60° to 68°.

Its western range of hills protects it from the cold winds that sweep in from the Pacific during the summer months, while the interior bays serve to modify the heat of the summer sun. The winter frosts are light and of short duration. Roses, geraniums, and other plants bloom throughout the winter season.

The average rainfall is from 18 to 23 inches, which is ample for all purposes of agriculture, horticulture, etc., and there is seldom a season when there is a shortage. The rainy season usually begins in November and ends in April.

SOILS.

In a report on the soils of Contra Costa County, based on samples taken from one of its principal valleys, Professor Hilgard says:

"This specimen represents the prominent soil features which lie around the landward and northern and western base of Mount Diablo, bordered by outlying spurs of the Contra Costa range. The plains are dotted with large white oaks, which are especially thick near the borders of the streams. Close to the latter we generally find streaks of black, heavy, loamy earth; but farther away the soils are mostly lighter, both in color and texture, and more or less intermingled with gravel. Sometimes gravel ridges of greater or less width indicate the course of ancient channels, and gravel evidently underlies a considerable portion of the plains, facilitating drainage. This is most important, as the prevalent character of the soil is that of clay loams.

"Regarding the soil specimen under examination, while it is taken to the depth of twenty inches, wells dug in the neighborhood show no change of tint to the depth of sixty feet, showing an enormous accumulation of an evidently alluvial soil-mass.

"The sample sent is a brownish-gray loam, which, on wetting, softens quickly and without change of tint. The coarse portion consists mostly of flattened particles of hard shale and quartz, well rounded on the edges.

"The analysis of this soil results as follows:

		Per Cent.
Coarse materials		10.75
Fine earth		80.25
Analysis of Fine Earth.		
Insoluble matter	63.279	72.12
Soluble silica	8.842	
Potash		.77
Soda		.57
Lime		1.69
Magnesia		2.36
Br. oxide of manganese		.17
Peroxide of iron		4.91
Alumina		12.86
Phosphoric acid		.06
Sulphuric acid		.01
Water and organic matter		5.03

"Chemically the soil shows a large supply of potash and lime, and as regards the latter, there can be no doubt that it is a general characteristic of the soils of Contra Costa County, since lime is abundant in the rocks on the flanks of Mount Diablo, as well as on the Contra Costa range. On the banks of Walnut Creek, the lower portion of the black loamy earth, just above the gravel that underlies at some five feet depth, is full of white gravel or lime concretions.

"The proportion of phosphoric acid in any case would be counted above deficiency. But the determination of its solubility shows (under the head of available phosphoric acid) that practically all of it is in the available state. The soil has a good supply of humus, and therefore of nitrogen. Its power of absorbing moisture is high, and with its depth, constitutes a safeguard against drought and hot winds.

"Its fruit product can not fail to be both abundant in quantity and high in quality, and its best general adaptation would seem to lie in the direction of pears, apricots, grapes, almonds, peaches, etc."

The above analysis and description of soil relate particularly to the Ygnacio Valley, but the soils of the connecting valleys of the Alhambra, Diablo, or Clayton, San Ramon, Briones, and Lafayette are so similar in character, being the alluvial deposits of the same range of hills, that this analysis fairly represents all the above-named valleys.

The following analysis of soil from Burgundy, France, where is produced the most famous wines in the world, shows a wonderful similarity to that of Contra Costa:

Coarse material	9.75
Fine earth	81.85
Analysis of Fine Earth.	
Insoluble matter and soluble silica	78.21
Peroxide of iron	5.25
Magnesia	3.98
Alumina	7.47
Organic substances	5.39

In depth, the soil throughout the county shows a remarkable continuity of rich alluvial deposits underlaid by limestone or clay. There is an occasional change to a coarse sandy and gravelly heavy loam of black or brown tint. It has great power for enduring drought, and is easy to work, giving large returns with careful culture. Trees and vines seem almost to laugh in their growth as they push their roots down into this fat soil. The soil in the uplands is in character similar to that of the lowlands, and being drier, is for some purposes even better.

In common with nearly all the coast counties, irrigation is not required to insure crops. The abundant winter rainfall, the absence of the intense evaporating heat of the interior, and the moisture-laden breezes from the ocean, furnish abundant moisture for all forms of vegetable life without recourse to artificial irrigation.

FRUIT CULTURE.

The tourist passing through the many beautiful valleys and over the rolling hills throughout Contra Costa County is impressed with the similarity of its general characteristics to the gentle slopes of sunny France. Scattered in all directions are numerous small vineyards and orchards, that with but little cultivation produce the richest results. Beyond and around the northern and western base of Mount Diablo is an uninterrupted body of splendid farming land. There are plains dotted with white oaks, and streams bordered with cottonwood and willows. The wild-oat hill lands, when exposed to the south, are nowhere equaled in the State for olive culture; and there is fruit land all over the county, and no irrigation is required. Among numerous kinds produced, each embracing all the superior varieties, are the pear, plum, prune, apricot, cherry, peach, quince, fig, apple, nectarine, pomegranate, olive, persimmon, orange, lime, lemon, date, grape, strawberry, raspberry, gooseberry, blackberry, currant; and among nuts, the pecan, filbert, almond, walnut, chestnut. Over 8,000 acres of land are devoted to these fruits in Contra Costa County, and wherever fruit-growing has been tried it has proven successful and remunerative.

AGRICULTURE.

Notwithstanding the growth of the fruit industry, grain-raising is still very prominent in this county. Many farmers have grown rich from wheat production. The chief product of the eastern section is wheat, although much barley, hay, alfalfa, and fruits and vines are grown. Alfalfa around Byron yields 7 to 10 tons per acre per annum, without irrigation, and is worth from $9 to $12 per ton in San Francisco, according to the season. A very large acreage is planted to wheat, oats, barley, and hay.

The raising of sugar-beets is now a growing industry, the increase in acreage this year being close to 1,500 acres over 1901.

Vegetables of all kinds are raised very profitably and on an extensive scale; one tract of land of 2,000 acres is used entirely for the production of asparagus for early Eastern shipment. Potatoes, beans, etc., are also a very prolific and profitable crop in this county, especially in the central portion.

Natural feed is very abundant, both on the hillsides and at a higher elevation, affording the finest kind of pasturage during both summer and winter.

STOCK-RAISING.

Stock-raising is a most profitable industry, especially fine stock, and considering its size, no county in the State can show better grades of blooded stock. The Oakwood stock farm of 6,000 acres is one of the finest in the State; it has a large number of draft horses, 300 standard trotters and pacers, 200 Devons, and 200 Shorthorns—all of the finest grades; also fine flocks of pure-bred sheep, besides hogs and poultry. Many business men of San Francisco own ranches in this county, and take great pride in their development. Western Contra Costa is especially well adapted to stock-raising and dairying, owing to the fogs and moisture, and the resultant luxuriant growth of natural grasses and their long endurance—early to spring up and late to disappear.

MINING AND MANUFACTURING.

The only important mining industry is the coal mines of Mount Diablo, although some little mining for precious metals has been done. Prospecting for oil is now receiving considerable attention, with good indications of developing producing wells.

The terminus of the Santa Fé Railroad is located at Point Richmond, in this county, and many substantial improvements in the way of wharves, etc., on a very extensive plan, have been constructed at that town.

Port Costa is the shipping point for the bulk of the grain raised in

California; has warehouses for storing over 160,000 tons of grain, with a dock frontage of 2,500 feet, affording facilities for loading from eight to ten large ocean ships at the same time.

At Pinole are located large stockyards; near Vallejo Junction is the largest smelting works in the State; at Vallona are extensive lumber yards, where ships from Oregon and Puget Sound discharge cargo. At Crockett are flouring-mills of the capacity of 10,000 barrels a day; also agricultural works.

DEL NORTE COUNTY.

Del Norte County lies in the northwestern corner of California, and is bounded on the north by Oregon, on the east by Siskiyou, on the south by Humboldt, and on the west by the Pacific Ocean. It has an area of 1,546 square miles, or 989,440 acres.

The eastern portion of the county is mountainous, but in the southern and western parts there is much good agricultural and grazing land. The area suitable to cultivation is confined to the Smith River Valley and a belt along the ocean near Crescent City. A large portion of this county is covered by vast redwood forests, and these extend in an almost unbroken belt from the southern boundary to the Oregon line on the north, with an average width of 40 miles. This land when cleared is very fertile, but the labor of removing the immense redwood stumps and clearing off the partly decomposed logs which cumber the ground is so great as to preclude effort in that direction.

The entire area is practically a succession of mountain ranges broken into narrow valleys. That portion of the Coast Range which traverses the eastern part reaches an altitude of 5,000 to 6,000 feet. Snow remains on the summit of these mountains until late in the summer, and they are rugged and precipitous in the extreme.

Del Norte has an ocean frontage of about 35 miles. The Klamath River is a large stream. The greater part of its course is through this county, which it leaves on the southern boundary entering Humboldt, then reënters Del Norte and empties into the Pacific. Smith River is also a stream of considerable magnitude. Besides these there are a large number of creeks tributary to them, making of Del Norte one of the best watered counties in California.

Del Norte lies within the moist belt, and the precipitation here is much heavier than in most of the counties of California.

The soil in the valleys and foothills of Del Norte is very fertile, that of the valleys being devoted chiefly to dairying, which is here the principal industry. In the foothills some excellent fruit is grown, but in limited quantities, and principally for home consumption. An occasional orchard of apples, pears, and peaches proves that the soil and climate here are well adapted to horticulture, and gives promise of the extension of this branch of industry whenever easy means of reaching the markets shall be had. In Smith River Valley some very excellent apples are produced, and pears, plums, and cherries thrive here as well as in any part of California.

The chief industries of the county are dairying, lumbering, and to some extent mining. Comparatively little land is under cultivation, the average being but seven acres to the square mile.

While Del Norte produces a large quantity of apples, the bulk of her product is consumed locally, but a small portion of it finding an outside market, and this finds its way to San Francisco.

The soil and climate of Del Norte seem especially adapted to the growth of apples. The former is generally a deep, black loam, very rich and easily worked, and the climate is marked by great humidity, and but little very hot weather. While some small family orchards have been bearing in Del Norte for many years past, some have been planted as early as 1850–53, and are still vigorous. Fruit-growing as a business has never obtained a foothold in the county.

Dairying is one of the principal industries, and the output of butter during the year 1901 was over 500,000 pounds, of which 310,000 pounds was the product of creameries. There are quite a number of creameries, well equipped, and second to none in the State. As regards the quality of their output, it is mostly shipped to San Francisco.

While agriculture is carried on only on a very limited scale for home demand, good crops of hay and barley are raised; potatoes and other vegetables of a very superior quality are always a sure and profitable crop.

Lumbering is another principal industry. Sawmills and shingle-mills give employment to quite a large number of persons. The annual shipment of lumber reaches very close to 20,000,000 feet, besides a large output of shakes and shingles. There are now over 190,000 acres of fine redwood timber, besides large bodies of tamarack and other commercial timber.

From the last reports of the United States General Land Office there were over 470,000 acres of unappropriated government land, classified as mountainous, timber, grazing, mineral, and broken lands.

Considerable capital is invested in salmon fisheries, and the output of the fish canneries established on the Klamath and Smith rivers is quite large.

The mineral possibilities of the county offer a fine field for prospectors for gold, copper, and other metals.

The principal towns are Crescent City, located on the coast, and Smith River, located in the center of the dairy and farming districts.

EL DORADO COUNTY.

El Dorado County is on the eastern line of California, a little north of the center. It is bounded on the east by the State of Nevada, on the south by Amador County, on the west by Sacramento, and on the north by Placer. Its greatest length, east and west, is 78 miles, and its extreme width is 40 miles. The area is 1,890 square miles.

CLIMATE.

No similar area in the world contains greater variety of climate with a more agreeable and healthful general result. It is a region of very curious contrasts, owing to the great difference that elevation makes in climatic conditions. On the west the county borders on the plains of the Sacramento Valley, where snow never falls. On the east it contains the summits of the Sierras, where snow is often twenty feet deep in winter and is nearly perpetual. Between these two extremes there is every gradation. It is above the line of fogs. Thunder storms are rare, and never dangerous. Heavy winds are not feared. Snow is seldom seen in the central and western portions, and orange trees are now growing along the western side. The evenings are never sultry in summer, nor the heat oppressive during the day. In spite of the thermometer occasionally registering 100°, sunstroke never occurs, owing to the dry atmosphere. It is a healthful climate, and is peculiarly favorable to asthmatic patients, who breathe easily at elevations of 2,000 feet when they can not live comfortably in the Eastern States, or on the coast line or in the valleys of California. The rainfall averages about 46 inches annually at Placerville, lessening toward the west and increasing with greater elevation. At Placerville it is seldom less than 35 inches, and has reached 72 inches. Failure of grain or hay crops from drought is unknown. In the dry season, from June until October, there is much irrigation, water being conveyed from streams through over 350 miles of ditches for mining and agricultural use.

AGRICULTURE.

The surface of the county is what is called foothill land, and is much broken. The man who expects prairie land in wide, level tracts will be disappointed. The soil, when properly handled, yields good returns from all the cereals in either hay or grain. They are all raised entirely without irrigation. Clover and alfalfa do well in the county, but usually require irrigation. The yield is sometimes astonishing, several crops being cut in the season.

Indian corn does as well here, when irrigated, as in the Eastern States.

Amber cane, or amber sorghum, thrives. It does not produce as many gallons per acre as in the East, but yields a clearer and sweeter syrup, and sugars readily.

FRUIT-GROWING.

The broken surface of the county, giving thorough drainage, is exactly what is required for highly flavored fruit, hence the county has been celebrated for the high quality of these products since the first peaches were marketed from Coloma. In the western part of the county, olives, figs, and grapes of all kinds are almost perfectly adapted to the soil and climate. Farther east, at elevations of from 500 to 2,000 feet, peaches, plums, nectarines, prunes, and cherries reach perfection in color and flavor. Apples and pears do their best still farther east, at elevations of from 2,500 to 3,500 feet. Nearly all these fruits will grow anywhere in the county except at extreme altitudes, but they give the best results in the regions named. W. I. Hartwick, six miles east of Placerville, sells apples to dealers in Old Mexico, receiving $1.50 per box for them at his express office. The cost of the apples at their destination is about $5 per box, yet the dealers have contracted for his next year's crop of this variety.

Grapes thrive quite well far into the eastern part of the county. The Cedar Hill Vineyard, near Placerville, has produced some of the finest table grapes in the State and has shipped them to Mexico and other distant points for special demand.

Orange trees thrive and bear along the western border of the county, but have never been cultivated as a commercial undertaking.

There are thousands of acres adapted to growing olive trees, and the demand for oil and pickled olives is increasing rapidly. The market for pickled olives as a food product is growing rapidly, and in time they will become a staple in this country as they are in southern Europe and Asia. D. Johnston & Sons, of Sacramento, have a thrifty olive grove near Pilot Hill, from which they are now producing oil of fine quality and pickled olives that find ready sale. Their oil sells at from $5 to $6 per gallon.

All the berries thrive with but comparatively little attention. Almonds, walnuts, chestnuts, and peanuts will grow and produce well.

VEGETABLES.

All kinds of vegetables do well under irrigation. Potatoes, cabbage, and beets attain a size that would astonish Eastern gardeners. D. H. Thompson, of Georgetown, raised ten tons of potatoes of large size and excellent quality on one acre last season. He sold them at 1½ cents per pound.

DAIRYING—POULTRY-RAISING.

Dairies in this county migrate, being located in winter on the western ranges; in summer, far in the mountains. The business is profitable, but until recently the methods have been very crude, and dairymen are only just beginning to introduce modern methods and machinery.

Many places in the county are adapted to raising poultry. Eggs are still shipped into California and into this county from points farther east, the markets of the State not being supplied by local production, although the poultry products bring fair prices.

GOLD MINING.

The county received its name from the great quantities of gold discovered here in the early mining days. It is the pioneer county, and was the scene of Marshall's discovery and of the first excited gold-rush. The gold of the shallow, easily accessible placers is now mainly gone, although several hundred people in the county still engage in this primitive industry. The county is crossed from north to south by several highly mineralized belts, the central one being the famous "Mother Lode" of California, all of which contain ledges extending thousands of feet into the earth's crust and bearing more or less gold. It is reasonably certain that gold mining in these fissures will be prosecuted for the next two hundred years, and, in all probability, for a much greater time. It is the history of quartz mining that a body of paying ore is discovered, is worked profitably for awhile, then lost and the mine abandoned. Years later the same mine is opened again, new ore bodies are found or the continuation of the old one discovered, and a new lease of life is given to the property. The process has been repeated many times. Nearly all the famous producing mines of California to-day are old, partially-worked, abandoned mines, reopened and worked under better conditions than existed when work was suspended. Mines that would not pay under old-time methods and expenses, will often yield a handsome profit under modern economy. Capitalists who recognize these facts in making their investments should seek, not the locality where a strike has just been made, and where holders of mining property under excitement ask enormous prices, but rather the locality favorable in its conditions as a gold producer, yet where immediate excitement is lacking. If capitalists will exercise the same prudence and careful management in quartz mining that they exhibit in other business ventures, select their managers or superintendents from those who have proved their executive talent and economy in addition to their technical and practical knowledge of mining; if they will see that their money is expended in actual mining and not in showy display and wastefulness above ground, they will mine in the gold belt of El Dorado County, or in any other of the mining counties of California, with as much certainty of success as attends other lines of business. Two thirds of the failures in mining have been the fault of the so-called "miners," and not the inherent worthlessness of the mines. It has frequently been observed in California that the new owners of a mine build a forty-stamp mill and a small village before they have developed the mine to know that they really need a mill. Similar reckless methods would wreck any other business enterprise if they were applied to it. In El Dorado County the existence of gold deposits in the rocks has been proved by thousands of rich discoveries, and mining on one portion or another of the mineral belt is always being prosecuted, the business being sometimes active, sometimes depressed. During a period of excitement the mining lands are always held at higher prices than when mining is stagnant, and the course for investors to pursue is to buy or bond their property and do their development work when the absence of mining enthusiasm enables them to obtain the initial benefit of low prices.

Other opportunities for the investment of capital occur in the ancient, lava-capped river channels of the county. A complete ancient drainage system of these channels is to be found, corresponding quite closely with the present streams. The ancient channels, buried from one hundred to five hundred feet, are nearly as numerous as existing streams. They all contain gold in gravel beds from two to twenty feet in thickness, which must be explored by the drifting process, involving considerable preliminary outlay. The ancient channels in the distribution of gold are exactly like modern streams. They are rich and poor in varying localities, but some of the most valuable mines of the county have been developed in them.

OTHER MINING.

Copper is found in two belts—one west of Placerville, the other about twenty miles east, where a large belt of limestone, highly mineralized along the walls, makes it a desirable field for exploration by prospectors for both gold and copper. Part of this belt at Indian Diggings has supplied some of the best marble found in California. A copper mine on the western belt is now being developed.

The limestone quarries at Marble Valley, on the western side of the county, supply a very fine quality of lime.

A tract of land near Placerville was recently sold to Oakland capitalists. It is said to contain material valuable for making Portland cement.

Rich float cinnabar has been found near Nashville, but no large deposits have been discovered so far.

Quite a large number of small diamonds of good color have been found in the gravels of the ancient river channels near Placerville and in other parts of the county.

Granite and lava rocks suitable for building purposes are abundant.

SLATE QUARRYING.

This county produces roofing slate equal to any in the world. The quarries are in a blue-black slate of the Mother Lode between Placerville and Kelsey. The slate splits extremely well and punches so readily that it is possible to drive nails through it without breaking it. The Eureka Slate Company is now shipping slate in carloads, much of it being used by the United States Government on Federal buildings. The California Slate Company is beginning to develop a quarry on the outskirts of Placerville. Some of the slate has been shipped to Mexico and to the Sandwich Islands. About sixty men are now employed by the Eureka Company. No better roofing material exists in the world than the slate of El Dorado County, and it is a product of which the people justly feel proud.

SCHOOLS.

The county is divided into fifty-five school districts, so arranged that every resident is provided with facilities for the education of children.

TOWNS.

Placerville, the county seat, contains about 2,000 inhabitants, and is the terminus of a railroad from Sacramento. It has five churches, a planing mill, two foundries, three newspapers, and all the usual business houses in a town of that size.

Next in size to Placerville is Georgetown, on the north side of the county, which also has a newspaper. El Dorado, Shingle Springs, Diamond Springs, and Coloma are smaller places, the last being the place where gold was first discovered in California.

LUMBERING.

The forests of the eastern part of the county support several small sawmills for local supply, and are also the scene of shake and lagging manufacture—the first being used for cheap roofing, the last in timbering mines. The El Dorado Lumber Company is now extending a narrow-gauge railroad from Placerville into the timber in the northeastern part of the county, expecting to ship lumber and wood extensively. It conveys a carload of lumber on a cable stretched across a river cañon 1,200 feet above the water.

POPULATION AND LAND.

El Dorado County, with an area approximating that of Delaware, contains less than 10,000 people. They are mainly either miners in their previous life and training, or they are the descendants of miners, who from their infancy have been used to the "free and easy" methods of a mining community. They are a liberal, hospitable people, and the kindest of neighbors and friends, but, with a few exceptions, life as a farmer or orchardist is not to their taste, and the economical habits of the genuine agriculturist are unknown to them. Many of them hold considerable bodies of land, of which, like Southern Californians of twenty years ago, they are making little use. Owing to these conditions, and the further fact that the paucity of manufactures in California is holding land values in general down much lower than they will be when such manufactures develop, as they will, sooner or later, the prices set upon land in this county are very low. Nowhere in the West can a comfortable home in as fine a climate as earth produces be obtained for as little money.

Inquiries in regard to the northern side of the county can be addressed to J. C. Horn, Georgetown. F. N. Spencer or A. T. Culbertson of Placerville will supply information relating to the central and southern portions.

FRESNO COUNTY.

Fresno extends across from the high Sierras to the mountains of the Coast Range, and in this center of the valley is reproduced all that is best and most wonderful in the valley. Every form of agriculture and every industry in any of the counties that make the watershed of the San Joaquin are found in a greater or less degree in this one county. Its mountains contain lumber and minerals and fine scenery; its level plains grow cereals and fruits, and vines and vegetables; it raises cattle, and its western borders overflow with petroleum. But in addition to this diversity of interests, it has, as a great mainstay, the raisin industry, with Spain as its only competitor.

The development of the county has been a matter largely of the last twenty years. The area of the county is twice and a half that of the State of Delaware, with 5,606 square miles, or 3,587,840 acres, of which it is estimated that 900,000 acres are readily arable. There is a population of 41,000, of whom between one half and one third reside in Fresno City, and all comparatively newcomers, and representing almost every nationality under the sun.

IRRIGATION FACILITIES.

The average rainfall is 10 inches, and therefore cereals can be successfully grown without irrigation. But Fresno is in fact another wonderful example of what irrigation has done and can do. The San Joaquin River forms the northern and eastern boundary line, but the stream is not so well located for irrigation purposes as is the Kings, which, rising in the Sierras, passes south, and then west and north, in a wide curve, through the center of the farming district, carrying, through the summer months, a volume of water equal to 8,500 cubic feet per second.

There are 300 miles of main canals, 1,000 of branch canals, and 5,000 of distributing ditches. The region is a network of streams of water, waiting to be drawn off on the vineyards, deciduous or citrus fruit orchards, or alfalfa fields to promote growth. The cost of water is low, the annual charge being about 65 cents an acre. The perpetual water-right, included with the purchase price of the land, is about $6.25 per acre.

AGRICULTURE.

Though great as the raisin and fruit industry of Fresno is, wheat is grown in vast areas, especially in the western section of the county, ranches running up in the thousands of acres and the product in good rainy years amounting to millions of bushels, a considerable portion being worked up into flour in Fresno, where one mill has an annual capacity of 140,000 barrels. Barley is grown in large quantities and so is alfalfa, though the greater part is fed to stock, of which hundreds of carloads are exported yearly. There are six creameries and many skimming stations in the county, and butter and cheese are exported. One creamery in Fresno city produces 6,000 pounds of butter daily. An unlimited market for dairy products, with the fact that one acre of alfalfa will support one cow in green feed, offers the farmer of limited means openings for immediate and profitable returns. Sheep by the thousands roam over the foothills, the wool clip in seasons amounting to about 15,000,000 pounds.

FRUIT CULTURE.

Deciduous fruit shipments, green and dried, represent $1,000,000 a year. Citrus fruit growing is a developing industry, representing at this time $100,000 and growing yearly. Watermelons are exported in hundreds of carloads, for it is only in the last few years that Fresno has outrivaled Lodi in San Joaquin, which for years was the melon-shipping center of the State. The vineyards cover about 40,000 acres, of which about 32,000 are in raisin grapes, and the remainder in wine or table varieties. There are over a dozen large wineries in the county, one of which, owned by the California Wine Association, ships 250,000 gallons a year. Excellent port, brandy, sherry, and angelica are made, as well as other varieties. This product is valued at over $1,000,000.

At the head of the long list of valuable products stands the raisin, with a tonnage of nearly 4,000 carloads. When a vineyard is in full bearing it produces about 4,000 pounds of green grapes to the acre, which will dry to over one ton of raisins. The average product of five-year-old vineyards is a ton of raisins to the acre. The California raisin has possession of the American market, on a reasonable tariff, which keeps out the cheap foreign product, without allowing an exorbitant price to be charged for the home-grown article.

OTHER INDUSTRIES.

The growing of nursery stock is a remunerative occupation. Honey is produced in considerable quantity, and more so with the increased product of alfalfa. Alfalfa honey equals in quality clover honey of the East. Gold is mined in the mountains, and 50,000,000 feet of lumber cut annually, most of which is floated down in flumes. There are large planing mills and many lumber yards in the city of Fresno.

DAIRYING.

The growth of the dairy business in Fresno County dates back less than four years, when smaller interests merged and became what may be properly called a large clearing-house for butter-fat. Before this, dairying was conducted in a desultory way by ranchmen who gave their time to grain, vineyards, or other possessions, and, these permitting, the cows received attention later on. At this time the farmers find it advisable to attend to their cows. Thirteen skimming stations, covering the territory from Madera to Guernsey, are established, and are buying cream in Kern County as well.

The farmers deliver their milk at the skimming stations, and the butter-fat being removed, the skimmed milk is returned to them, worth from 20 to 30 cents per 100 pounds, if properly utilized for feeding swine. The average price paid last year to the farmer for butter-fat was 21½ cents per pound. This makes it possible for the farmers with even ordinary stock to realize an average of $5 per month per cow during the milking period.

It is certain that with sixty acres and a herd of forty cattle, a farmer can have milk the year round, which will give him some cash every month and none of the troubles incidental to the other industries of the county. Taking as an instance the result from a herd of Holsteins, beginning in October, 1900, and ending with September, 1901, the argument is convincing that the higher the grade of stock, the better the returns, as herewith shown:

Month.	Pounds of Milk.	Value in Cash.	Number of Cows Milked.	Per Cent of Fat.
October	33,560	$311 40	47	6.62
November	33,493	312 52	55	5.68
December	32,380	373 85	60	6.23
January	27,664	278 34	60	4.30
February	26,387	219 96	60	3.66
March	29,825	173 18	40	4.32
April	31,622	172 75	45	3.82
May	25,211	146 31	33	4.43
June	24,886	135 50	45	3.01
July	30,847	178 25	34	5.24
August	30,975	206 25	34	6.05
September	28,500	192 00	36	5.55
Totals	366,260	$2,699 31	549	58.60

The calves and hogs were fed on the skimmed milk, and were, of course, as much a part of the dairy product as the cream itself. The calves were sold at an average age of twelve weeks, and brought from $10 to $50 a head, according to the breed of the animal and the promise for the future, many of them being pure-bred Holsteins, while others were "grades." These calves and hogs as by-products of the dairy averaged in value $19.35 to each cow during the record term.

The value of the milk to the creamery was, of course, in the butter-fat, which brought $2,699.31. The calves and hogs sold during the same time brought $871.11, which, added to the receipts from the butter-fat, made a total income from the dairy of $3,570.42. The expense account stood as follows: For labor, $1,192.82, and for feed, $888.75; making a total of $2,081.57. $3,570.42 less $2,081.57 left a net balance of $1,488.85 to the owner of the herd.

The butter-making process as observed in the creameries is a wonderful improvement on that of three years ago, when, in the main institution, the first churning produced 150 pounds per day. The average dairy production in one creamery alone is 2,500 pounds, notwithstanding the scarcity of milk this season. Feed is becoming more plentiful and the cows are calving, so it is expected that with the ordinary cattle this summer there will be an output of 6,000 pounds of butter daily as compared to 4,500 in the corresponding months last year. There are 476 farmers delivering milk at the skimming stations.

The market for Fresno County butter is two thirds at home in the San Joaquin Valley, and the prices have ranged from 17 to 30 cents per pound.

WOOL-GROWING.

While in the San Joaquin Valley, as a whole, the raising of sheep is still a great and lucrative industry, the business within the boundaries of Fresno County has materially decreased in volume. This has been due to several causes, but principally to the rapid settling up of the country, the subdividing of large tracts of land, and the consequent reduction of areas formerly used for pasturage. Along the river bottoms of the Kings and San Joaquin, however, sheep-raising flourishes to an extent that would make an Easterner's eyes bulge out. Here, between the months of October and April, scores of bands of sheep averaging in number all the way from 500 to 1,000 are herded year after year. The section is a fertile one, rich in herbage upon which the animals thrive until the dry season sets in, when they are driven into the mountains.

The section around Firebaugh, 45 miles west of Fresno, is the chief sheep-shearing station in Fresno County. There are usually three shearings a year, from April to August, and this shearing season, as may be imagined, is a particularly busy one. The work is done largely, almost exclusively, by Portuguese, Mexicans, French, Spanish, and Italians, and the annual assemblage of this small army of foreigners makes the little town of Firebaugh a scene of the liveliest activity.

During the last few years, as intimated above, there has been a marked falling off in the production of wool, as far as this county is concerned. Whereas something like 3,000 bales per year came into Fresno City during the most thriving period of the business, only about 1,000 bales are handled at present, and it is said that the production of wool in this county would soon decline further but for the prevailing good prices of mutton, which assist in making it profitable. In a word, Fresno has been the first county in Central California to feel the effect of the rapid development of the country in other lines. Adjacent sections must also be affected by it at no distant day and the wool-growing industry must, in the natural course of things, be relegated to those parts of the country, such as Arizona, New Mexico, Nevada, and Wyoming, which offer wide and uninterrupted areas for grazing purposes.

STOCK-RAISING.

The raising of hogs, cattle, horses, and mules in Fresno County is advancing both as to numbers and as to quality in breeding. From 5,000 to 7,000 hogs are being annually shipped from this county to Honolulu. These average in weight about 150 pounds, and are fattened for the most part on alfalfa. Only for about a month immediately prior to shipment is it necessary to feed grain so as to produce the required condition for transportation. One rancher, within a few miles of Fresno City, has sown 3,000 acres to alfalfa for hogs and cattle, and this is being done in many parts of the county. Large numbers of cattle are being received continually from Arizona to be fattened and either slaughtered here or reshipped to San Francisco and elsewhere. Thus the number of beef cattle in the county is being added to as rapidly as it is diminished by the demands of the local and northern markets, and there are between 50,000 and 75,000 head always on hand. The facilities for fattening beef cattle in this section are unsurpassed, and prices for the dressed meat or for the fattened cattle on the hoof are always good.

Gratifying results are being attained by horse-breeders who have for several years given their attention to the improvement of the blood lines in the various classes. Thoroughbred, standard-bred, and high-class draft stallions have been brought into the county, and great interest is manifested among horsemen in raising the grade of the runner, the trotter, and the work horse. Some of the best roadsters in the State are in Fresno and very promising youngsters in the running line are also attracting attention, while the production of the heavier breeds has met with equal success.

In a general mention of the varied resources of this glorious county there must be no omission of the great American mule. In this valley he finds an environment peculiarly adapted to his exacting requirements, and speedily attains the highest degree of mulish perfection. So widely has his reputation spread that Great Britain sent her agents across the sea to acquire him for use in her warfare against the Boers of South Africa. These agents are in the valley to-day buying up all the mules obtainable, and the market, always good, is especially so at this time.

STATISTICS.

At the end of the last fiscal year, in June, the total value of all property in the county was $28,270,578, an increase of $2,306,750 over the year previous. Comparisons may be made from the following figures for the years 1900 and 1901:

	1900.	1901.
Value of real estate, other than city and town lots	$14,270,707	$15,572,558
Improvements on same	2,313,613	2,265,186
City and town lots	3,885,746	3,667,997
Improvements on same	2,512,078	2,816,620
Personal property as per schedule	2,847,413	3,701,275
Money and solvent credits	134,271	154,292
Value of property affected by mortgages	6,999,957	6,895,348
Assessed value of trust deeds and mortgages on real estate	4,779,125	4,565,740

Acreage planted to nearly all crops shows an increase. Thus the acreage in grapevines in 1900 was 62,970; in 1901 it had increased to 67,770. In the former year Fresno County had 19,850 orange and 3,840 lemon trees in bearing. At the end of last year she had 20,740 and 3,900, respectively.

Bearing fig trees in 1900 were 31,525; at the end of last year, 32,300. Bearing olive trees in 1900 numbered 14,896; in 1901, 15,420.

Except as to corn and barley, the figures show a decrease in the grain acreage. The number of acres sown to wheat for the crop of 1900 was 145,800; in the following year it dropped to 135,700. There was a very marked advance in the acreage sown to hay, the figures being 4,850 acres for 1900, as against 13,600 in 1901.

These figures tell their own story, indicating, as above stated, a solid and healthy condition of things that ought to be matter for congratulation from every quarter.

GLENN COUNTY.

Glenn County is one of the youngest in the sisterhood of California counties, having been separated from Colusa by Act of the Legislature of 1891. Its area is 130,000 acres. It is bounded on the south by its parent county, Colusa, on the east by Butte, on the north by Tehama, and on the west by Trinity and Mendocino. It is one of the Sacramento Valley counties, and is located on the eastern slope of the Coast Range, on the western side of the valley, and extends from the summit of the Coast Range to the Sacramento River, these forming its natural eastern and western boundaries.

The eastern portion of the county consists of level valley lands, which change into rolling hills on the west, becoming more extensive and precipitous in the foothills of the Coast Range until they merge into the mountains.

Willows, which is the county seat, has a beautiful location in a gentle slope of the Sacramento Valley. No finer view can be presented. With its productive fields looking toward Mount Shasta to the north, the Sierra to the east, and the foothills of the valley and the Coast Range to the west, a land of loveliness and grandeur is presented to the eye.

What has been said of the climate of Colusa holds good of Glenn, there being but little difference between the two.

SOILS.

The soil is generally of a fertile character, and ranges from a rich black loam in the bottom lands along the river to a more gravelly soil in the higher and foothill regions. The rich clay land of the western foothills has proved itself well adapted to fruit-growing, and some excellent results have been obtained. The hills surrounding the small valleys present any variety of surface, and are adapted to the culture of a great variety of vegetable products.

IRRIGATION, AND FACILITIES THEREFOR.

During the summer of 1900 about 600 acres were irrigated by ditches from Stony Creek, about 100 acres by pumping from the Sacramento River, and about 40 acres by pumping from wells. About one third of the deciduous fruit orchards are irrigated, and all the orange and lemon. All the lands of the county are excellent for irrigation. Stony Creek is the only stream from the mountains flowing through the county to the river. In the late fall this creek furnishes but little water to the irrigators on the plains, although those in the foothill valleys along its course have water enough, as does everybody in the spring and early summer. However, a great deal of work is now being done on the lower ditches, and we expect better results hereafter. Few streams anywhere offer better facilities for the storage of water than this one does. The

Geological Survey has just completed its investigations along Stony Creek, and reports many excellent reservoir sites, three of which were carefully measured, with the following results: Briscoe reservoir, with a capacity of 14,630 acre-feet, can be constructed at a total cost of $122,000; East Park, capacity 25,000 acre-feet, cost $165,400; Millsite, capacity 45,750 acre-feet, cost $698,000. This cost includes a liberal estimate for land damages.

There is an inexhaustible supply of water underground, at a depth of from 12 to 30 feet, in all parts of the valley lands. At Orland, one well, in which the water stands at 20 feet, furnishes 18,000 gallons per hour throughout the irrigating season. There are several other wells there that supply smaller pumps. The water is raised by windmill, horsepower, and gasoline engines.

PRODUCTS OF THE SOIL.

Farming and stock-raising are the principal industries. Fruit-growing, etc., is as yet in its infancy. Until within the last few years the whole arable section of the county was devoted to the production of wheat. This commodity being unprofitable, except on a large scale, forced the smaller farmers into diversified farming, and to-day along the river can be found many small places where a comfortable living is made from vegetables, melons, peanuts, etc. Others are engaged in dairying and stock-raising. It has been demonstrated satisfactorily that the smaller the farm the greater the profit per acre.

The river land can be purchased in small tracts at from $25 to $100 per acre. The Sacramento being navigable for good-sized steamers and barges all the year, the time is not far distant when this land will be held at as high prices as now prevail in Los Angeles and Riverside. Here is to be found a real paradise to the persons from the hilly or rolling lands of the East. This is the valley of Stony Creek, a stream running from south to north, just the reverse of the Sacramento River, along the whole length of the county. Along this creek can be found alfalfa patches, fine cattle, fat hogs, orchards of prunes, apricots, peaches, pears, and figs, and vineyards. Oranges are to be seen in the dooryards, but no one has made it a business.

There are some extensive stock ranges in the hills, where the land has never been disturbed by the plow. In these ranges are many fertile valleys that could be converted with little waste of energy into happy homes. This land is worth from $4 to $20 per acre. The irrigated land, when sold alone, brings about $100 per acre. This land will produce at least four crops of hay each year, of two or three tons per acre, worth $4 or $5 in the field. It is thus not difficult to figure a profit on land at $100 per acre.

Many persons in this section derive a handsome living from poultry. Flocks of 500 to 600 turkeys are not uncommon. Chickens are the money-makers all over the county. Eggs always bring a fair price, averaging about 25 cents a dozen. Chickens sell at from $3 to $6 per dozen, turkeys at about 15 cents per pound, and ducks and geese bring fair prices. This industry is particularly safe and profitable, on account of the absence of epidemics among the fowls, the mild winters and dewless summers being conducive to longevity with the fowls as well as with mankind.

Cattle, sheep, and hogs are the chief revenue producers in this portion.

The high prices prevailing for the past three years have placed several stock men in a most enviable position among financiers.

It is well to state here that there is not a farm in Glenn County not accessible to a schoolhouse, as Glenn County prides itself on good schools and good roads.

ANGORA GOATS.

Less than fifteen years ago the Angora goat was a rarity in Glenn County. Now between the north fork of Stony Creek and the south fork of Elder Creek, there are more than 15,000. The portion of the county devoted to their production is immediately along the base of the Coast Range, or of foothills, a country that is unfit for anything else but wild animals. The Angora is by nature fitted to climb over rocks, and in brush and rough mountainous localities to procure food where other domestic animals would not succeed in even living.

The long silky mohair is valuable for various purposes, and is coming into use more and more each year.

Angora mutton or venison is far superior to the Mexican or old American goat, and by many is considered better than sheep mutton. It has sold in the markets for the past two years at about the same price as sheep.

It is the practice of the Angora owners to keep them on the foothills for about eight months—from October to June—then move them to the summit of the mountains for about four months, during the hot season. By so doing the herds have green-growing feed the year through, and the cool climate of the higher altitudes tends to increase the length and fineness of the mohair.

This industry is a growing one, and as the Angoras are located where the land without them would be a total waste, it is greatly to the advantage of the county. There is room for many more as soon as they can be procured. The demand for stock goats is greater than the supply at present.

HUMBOLDT COUNTY.

Humboldt County extends from the 40th parallel of latitude, which is its southern limit, to about midway between the 41st and the 42d parallels, where it adjoins Del Norte County, and is with this one exception the most northerly county of California. Its boundaries are Del Norte on the north, Siskiyou on the northeast, Trinity on the east, Mendocino on the south, and the Pacific Ocean on the west, where the sinuosities of the coast-line extend some 175 miles. From north to south the county extends 108 miles, while in width it averages about 40 miles. It contains 3,590 square miles, or 2,297,600 acres of land. A good idea of its size may be had when it is stated that it is over one half the size of Massachusetts, and somewhat less than the State of Connecticut.

This area may be subdivided into the following classes: Timber land, 938,000 acres; agricultural land, 450,000 acres; grazing land, 500,000 acres; marsh land, 31,285 acres; mineral land, 125,000 acres; and unclassified lands, 253,315 acres.

TOPOGRAPHY.

The topographical features of Humboldt are varied and picturesque. The surface is extremely rugged, numerous spurs of the Coast Range intersecting the county in all directions, rising in many places to absolute grandeur.

Besides a number of smaller streams, the county is drained by two rivers of importance. Entering at the extreme northeastern corner, the Klamath traverses it for about 30 miles in a southwesterly direction, and there being joined by the Trinity, flows northwesterly 45 miles, and empties its waters into the Pacific Ocean just north of the county line. Entering the county at its eastern line, the Trinity flows about 30 miles and joins the Klamath, a river carrying a vast volume of water to the ocean. Among the minor streams are Mattole, Bear, Elk, Redwood, Little, and Mad Rivers, and Redwood Creek. Second to the Klamath is Eel River, navigable for small craft, such as scows, flat-boats, and small steamers. All these flow in a northwesterly direction, and are separated from each other by a high hill country.

Of the topography of the Klamath River country, the Humboldt "Standard" gives the following description:

"The Klamath is the second largest river in the State. This stream reverses the physical conditions which characterize the Sacramento. The latter stream takes its rise amidst the alpine surroundings of the Sierra Nevada, flowing from its snowy eyrie with great force and volume. Below Shasta it meanders through valleys of extensive width, great depth of soil, and marvelous fertility to San Pablo Bay; whereas, the Klamath takes its rise amidst a vast expanse of levels, consisting of lakes, swamps, and tules—all this lacustrine region being remarkably fertile when reclaimed—until, entering the rocky embrasure to the Coast Range, it rushes on through these defiles tumultuously to the ocean. On the south this condition is again reversed, through its tributary, the Trinity, this river flowing from the rocky defiles almost from the foot of Mount Shasta. If we could be suspended over the river in a balloon, we would find the outline of the stream fan-shaped, with its periphery extended between Shasta County in our State and Lake County in Oregon, 300 miles in width, running down to a point at Weitchpec, using the river from that point to the ocean as a handle. Its tributaries, the Trinity, Salmon, and Scott rivers, all flowing from the eastward, pour their annual floods into the parent stream, and, owing to the great elevation of their surrounding mountains, which reach a height of 6,000 and 8,000 feet, covered through the winter months to great depths with snow, which, under the hot sun and heated air, pour forth their aqueous tribute till the month of April, when these floods are usually at their height, these annual floods surpass anything in the State. It drains the waters of seven counties: Humboldt, Del Norte, Trinity, Shasta, and Siskiyou, in California, and Jackson and Lake counties, in Oregon. Its course, from its source, is west-southwest from Klamath Lake, and afterward southwest, making a sharp bend at Weitchpec, then north-northwest to the Pacific Ocean, where it is a mile wide at the mouth. The length of the river proper is about 250 miles; including the large tributaries, about 1,000 miles. It enters the ocean at about 41° 30′ north latitude, and the estuary can be easily distinguished for many miles at sea. Nowhere in the State can be found such testimony of that ancient geological period when this continent was submerged. This channel has been cut through by the silent and persistent erosion of the waters, until it has acquired a depth of 400 or 500 feet. In many places this channel was miles in width, notably at Orleans Bar, where it must have been many miles."

CLIMATE.

On the coast the temperature of Humboldt County is uniformly cool and pleasant, ranging from about 56° in the summer, to 45° in the winter. The heat increases after leaving the coast-line, the thermometer ranging from 52° to 100°, according to season. Freezing point is but rarely reached in the valleys during the winter, and it never snows except in the higher valleys and near the heads of streams. Snow falls every winter on the elevations back of the timber belt, and sometimes to the depth of several feet; it seldom lies, however, for more than a week or two at most. It has been said, and truly, that any variety of desirable climate is to be had in the valleys of Humboldt County, on her low, rolling, or high hills, or on her coast. It is warmer in winter and cooler in summer than in the heated valleys of the interior.

SOILS.

The soil of the bottom lands and on the hills next the coast is black; that on the bottoms is of a sedimentary composition and somewhat argillaceous, while that on the hills rules more of a sandy loam. The soil on the interior hills is composed of disintegrated rock, mixed with organic matter and decayed vegetation.

Humboldt needs no irrigation. The annual rainfall averages 46 inches, and crops have never been known to fail for want of moisture.

The capabilities of Humboldt County as a dairying and fruit-growing section are very great, and there can be scarcely a doubt that these industries are destined to assume much greater proportions in the future than they have in the past, or than they do at the present time.

FRUIT-GROWING.

Fruits of all kinds do well, particularly apples, pears, prunes, peaches, cherries, apricots, and berries. Strawberries and raspberries grow in abundance, and a small area of land in these fruits, well cultivated, will bring an immense return for the labor expended. In the vicinity of Eureka two crops of strawberries are produced per year, of fine flavor and great size. Raspberries bear from June to September, and even in December and January fine raspberries are found on the bushes grown in the valleys.

The yield of all kinds of fruit is generous, and in many instances prodigious, the limbs of apple, plum, and prune trees literally groaning under the weight of the fruit they often bear. Eel River Valley has, for a long time, been one of the finest sections of the coast for the production of apples. It would seem that the soil had been "made on purpose" to bring forth fruit of the most delicate flavor and juiciness, while the climate, neither too hot nor too cold, has doubtless much to do with the result.

In the Klamath River country climate and soil are well adapted to horticultural pursuits. Peaches are grown here as large as a teacup, and of the most luscious flavor. They can not be carried to any market, as they have to be packed on animals, and, from the tenderness of their flesh, are unable to withstand this rough transit. The grapes grown here are of fine flavor and firm flesh. The varieties for table use are particularly good, and the wine made from the wine grape of good body and flavor.

The principal fruit sections of the county are Camp Grant, McDarmidt, Rohnerville, Blocksburg, Upper Mattole, Arcata, Bottom, Eel River Valley, Garberville, and Phillipsville. All these sections are adapted to the apple, but peaches, prunes, pears, and many other varieties of deciduous fruits do well, while for berries the conditions seem perfectly adapted. There was a considerable acreage of new land set to fruit this year, but owing to the distance from market there is not the consideration paid to fruit-growing in Humboldt County that it deserves.

Humboldt County excels in apples, and of these the favorite varieties are Rome Beauty, Lawver, Stark, Wagner, Arkansas Pippin, Ben Davis, and the Bellflower. These find a ready market, being shipped to San Francisco by steamer.

DAIRYING.

In dairy products, Humboldt is one of the leading counties of the State, and produces more creamery butter than any other county. It has thirty-two creameries and a large number of skimming stations located throughout the county; its exports of butter alone for 1901 were very close to 4,500,000 pounds. Large quantities of high-grade cheese are also manufactured, and there is in operation a condensed-milk factory.

LIVESTOCK.

After lumber and dairy products, cattle, sheep, and wool are the most valuable productions. The annual sales of beef cattle are about 8,500 head; of hogs, 10,000; and of sheep, 10,000. The shipments of wool range from 600,000 to 1,000,000 pounds per year.

AGRICULTURAL INTERESTS.

The agricultural interests of Humboldt are varied; although making no pretentions to being a grain county, it raises abundant crops of oats, barley, hay, potatoes, peas, beans, and other agricultural products, as shown by table of shipments below, furnished by J. F. Thompson, editor of the "Humboldt Standard."

PRODUCE SHIPMENTS.

As shown by the records of the "Humboldt Standard," the exports of county produce for 1900 as compared with those for the preceding nine years were as follows:

Year.	Butter.	Fish.	Apples.	Wool.
	lbs.	*lbs.*	*boxes.*	*lbs.*
1891	1,496,495	2,101,900	----------	861,195
1892	1,930,952	1,072,700	15,526	867,950
1893	2,660,715	1,124,400	7,309	641,502
1894	3,325,286	891,550	11,923	1,079,258
1895	3,832,750	1,004,649	18,203	883,543
1896	3,859,810	970,600	7,002	964,702
1897	3,759,610	1,066,570	15,503	867,600
1898	3,914,160	748,240	34,822	422,000
1899	4,568,480	317,400	41,094	1,186,212
1900	4,321,435	369,721	55,715	187,830

The comparison of the shipments of the various items in 1900 with those of the banner year, 1899, are as follows:

	1900.	1899.
Animal Products—		
Butter, pounds	4,321,435	4,568,480
Condensed milk, cases	9,033	10,898
Cheese, cases	14	16
Wool, pounds	187,830	1,186,212
Hides, bundles	1,596	1,426
Tallow, barrels	118	285
Glue stock, sacks	1,222	1,390
Veal, carcases	2,885	2,553
Hogs, dressed	101	25
Mess beef, barrels	11	5
Mess pork, barrels	1	--
Calves' heads, sacks	100	137
Poultry, dozen	48	26
Turkeys, pounds	3,825	--
Eggs, cases	21	284
Wild game, sacks	11	--
Terrapin, cases	12	--
Frogs, cases	78	31
Animals—		
Beef cattle	6,604	5,624
Calves	2,124	1,815
Sheep	4,333	4,769
Hogs	3,459	5,137
Horses	7	20
Goats, Angora	90	--

	1900.	1899.
Fish—		
Fresh salmon, pounds	369,700	317,400
Salt salmon, pounds	--	3,200
Herring, dried, cases	21	--
Fruit—		
Apples, green, boxes	55,715	41,094
Apples, dried, cases	1,182	180
Prunes, dried, boxes	660	568
Prunes, dried, sacks	155	588
Pears, green, boxes	103	26
Miscellaneous, boxes	91	56
Berries, boxes	3	--
Grain—		
Oats, sacks	10,682	23,390
Barley, sacks	19	47
Vegetables—		
Potatoes, sacks	15,042	19,715
Peas, sacks	3,010	8,761
Seeds, cases	85	90
Lentils, sacks	72	29
Beans, sacks	48	--
Vetches, sacks	14	--
Manufactures—		
Leather, rolls	1,544	1,172
Leather, casks	2	--
Leather, sacks	4	--
Leather, cases	1	--
Leather, bales	3	--
Leather, crates	7	--
Mineral water, barrels	6	6
Mineral water, cases	121	129
Cider, barrels	65	155
Cider, cases	365	264
Vinegar, barrels	5	4
Indian curios, cases	4	--
Miscellaneous—		
Black sand, sacks	3	22
Junk, tons	283	29
Freight, tons	3,063	2,898

THE LUMBER INDUSTRY.

The largest and finest body of redwood timber on earth is found in Humboldt. The redwood forests contain about 538,000 acres, of which 50,000 acres have been cut, leaving about 488,000 acres of standing timber. It is estimated that this timber will yield an average of 100,000 feet of lumber products to the acre, which leaves a reserve of about 49,000,000,000 feet of redwood lumber yet to be cut. At the present rate of cutting, about 200,000,000 feet per annum, it would take 240 years to exhaust this supply. Besides the redwood, there is probably half as much other timber, consisting of pine, spruce, fir, madrone, oak and laurel.

The shipments for the year 1900, domestic and foreign, consisted of the following manufactures of timber:

Lumber	99,038,751 feet.
Shakes	16,698,270 pieces.
Shingles	472,018 M.
Railroad ties	87,032 pieces.
Pickets	57,970 pieces.
Posts	56,462 pieces.
Stave bolts	1,690½ cords.
Piles	1,900 feet.
Laths	15 M.

There were also shipped the following forest products not properly classified as lumber:

Finishings	12,000 feet.
Doors	6,992 pieces.
Moldings	392 bdls.
Curtain poles	188 cases.
Sash	6 crates.
Shade sticks	12 cases.
Mattress frames	18,242 feet.
Excelsior	3,595 bales.
Butter boxes, new	531
Butter kegs, new	50
Butter cutters	3 cases.
Ship knees	345 pieces.
Burl	19 pieces.
Tanbark	1,500 cords.

OTHER INDUSTRIES.

Humboldt is one of the most promising and prosperous counties in the State. With a population now estimated at over 30,000, nearly one third of whom are found in Eureka, the county supplies her own wants in the lines of agricultural products, lumber, fruit, and wool, and ships to other markets fully $800 worth for each family of five persons.

Humboldt, aside from lumber and shingle mills, has one first-class woolen mill, three tanneries, two iron foundries, and three machine shops outside of railway machine shops. It has two shipyards, one of which has built and sent to sea more than one hundred vessels.

Humboldt has eleven steam railroads, embracing upward of 150 miles of first-class track. Five of these are passenger roads, and all, in themselves or in connection with other roads, center in Eureka.

Though most of the arable land of this county has been entered, there are yet thousands of acres of government land open for entry, some of which will provide comfortable homes to those who wish to settle upon and cultivate it. The last report of the United States General Land Office, under date of July 1, 1901, gives 546,949 acres as being vacant.

INYO COUNTY.

Inyo County, the third largest county in the State, has an area of 10,156 square miles, or 6,499,640 acres. Its boundaries are the State of Nevada on the east, Mono on the north, Fresno and Tulare on the west, and San Bernardino on the south. The entire territory lies east of the Sierra Nevada Mountains, the summit of which forms the western boundary of the county, extending north and south a distance of 120 miles, with a width of 60 miles.

The topography of Inyo County is more marked than that of any county in the State. Here the Sierra attains its greatest elevation and the valleys their greatest depression. It is a county of rugged and giant peaks, among which are Mount Abbott, 12,400 feet; Mount King, 14,000 feet; Mount Williamson, 14,500 feet; Mount Tyndall, 14,386 feet; Mount Whitney, 15,000; and Mount Inyo, some 15,000 feet; upon which the snow of ages forever rests, and forming a giant wall upon its west, as if to shut it out from all connection with the State of which it forms a part, marked by precipitous and sharp outlines and deep chasms, such as to render an ascent to their summits from their eastern slopes almost an impossibility. A county where, to the eastward of those peaks pointing heavenward, the earth's surface sinks hundreds of feet beneath the level of the sea, as in that valley, once the valley of mystery and fear, known as Death Valley—a county of beautiful and fertile plains and forbidding wastes; a county of almost arctic frosts and torrid heat.

The agricultural portion of Inyo lies along the foot of the great Sierra range, and is in the main comprised in Owens Valley, through which courses Owens River. The valley is about 95 miles in length, with a belt of arable land varying in width from 2 to 8 miles, and lies at an altitude of from 4,000 to 5,000 feet. It contains about 180,000 acres of arable land, rated from fair to good, of which about 40,000 acres are under claim. Something near 25,000 acres are under cultivation, and irrigated mostly from the numerous brooks and creeks that come down from the snowy Sierra.

The increased area of land in cultivation during the year amounts to about 2,000 acres. There are sixteen irrigating canals in the county, and one new one is in course of construction.

Wherever water can be procured for irrigation the soil of Inyo has proved to be very fertile, and very large agricultural crops are produced in Owens Valley. In many portions of the county, however, the soil is absolutely sterile, consisting of vast alkali flats, beds of salt, and sandy wastes. The celebrated Death Valley, with its vast borax lakes, is in this county.

The climate of Inyo resembles that of southern Nevada. Occasionally light falls of snow come in the winter, but do not usually remain long on the ground. Frosts are frequent in the higher altitudes of the northern portion of the county. The annual rainfall is light, averaging at Independence from 6 to 8 inches annually.

Owens River, the chief stream, takes its water from the Sierra, and flowing a distance of 150 miles south is lost in Owens Lake. This river carries a volume of water 50 feet wide; average depth, 6 feet; flow, 5 miles an hour. Water comes running down in creeks from the mountains on the west, which afford a bountiful supply for household and irrigation.

Fruit-growing is not extensively followed in Inyo, and what is produced finds a local market. Some excellent apples are grown, and with better means of communication a profitable industry could be developed in the growth of this fruit. Peaches, pears, and grapes are also grown, and do well where properly cultivated.

There are a number of farmers in Inyo, all of whom have small orchards and vineyards, ranging from two to five acres in extent. These usually supply the demand for home consumption, and the surplus finds a market in the mines. The fruit produced is generally very excellent in quality, but the location of the county precludes it competing with the fruit counties of the State. Berries and currants do especially well in Inyo, and are very prolific.

The pasturage all along the Owens River is unsurpassed, and large numbers of cattle, sheep, and horses are raised. Apples, peaches, pears, and grapes thrive on the foothills, while wheat, corn, barley, oats, and hay are the crops raised on the lower lands.

The principal livestock industry of the county consists of the raising of cattle, horses, and mules for the Los Angeles and San Francisco markets. There are 20,000 cattle, 5,000 horses, 9,450 sheep, 1,200 hogs, and many jacks and burros on the ranges of the county. Feed is also supplied for a number of transient bands of cattle and sheep.

Alfalfa is raised on a large scale, and produces three or more cuttings of hay each season. In winter many large bands of cattle and sheep are driven into the valleys to the alfalfa fields for pasturage and fattened for the Los Angeles and other markets. This county produces corn in considerable quantities and of a superior quality, which is fed to stock and hogs; the latter bring good prices and are always in good demand.

The dairy and poultry interests are growing. There are four creameries and numerous skimming stations. The creamery product is of a very high quality, and while some is shipped to outside markets, the larger portion is consumed in the adjacent mining camps, which are the chief markets of the county.

There has been a considerable increase in the shipments of fruit, vegetables, and hay during the last year. The principal market is the new mining camp at Tonapah, Nevada.

Inyo is also celebrated as one of the banner honey-producing counties, the product of the bees, which feed upon the flower-covered foothills, being of a superior quality. Most of the product is shipped to the Chicago and New York markets, where it is in great demand.

The Southern Pacific Railroad Company has recently purchased the Carson & Colorado Railroad, which extends from the Mound House, in Nevada, to Keeler, in California, with a proposed extension to Mojave. The latter would divert the entire trade of Inyo County to Los Angeles.

The large and valuable deposits of nitrates in Death Valley will add materially to the wealth of the county. The Inyo Development Company, the only producer of soda by solar evaporation on the American continent, has lately erected a large plant to manufacture soda ash from the crude soda, evaporated from the waters of Owens Lake.

The climate of Inyo, especially that of the central and lower portions of the valley, is almost a specific for asthma, bronchitis, and pulmonary troubles. An invalid can pass the three hundred and sixty-five days in the year out of doors, and in almost all cases, when not too far gone, the county affords, with its even temperature and dry atmosphere, ideal conditions for speedy recovery.

KERN COUNTY.

Kern County comprises the southern part of the San Joaquin Valley and the greater part of the semi-circle of mountains which inclose it on all sides except the north. It is bounded on the north by Tulare, on the east by San Bernardino, on the south by Los Angeles and Ventura, and on the west by San Luis Obispo County. Its area embraces 8,100 square miles, or 5,184,000 acres.

The portion of the Mojave Desert embraced within the county lying east of the Sierra Nevada Mountains has an elevation of about 1,800 feet. It is only a desert by reason of the scanty rainfall and the absence of water for irrigation. The Tehachapi Pass, being a low depression between the San Joaquin Valley and the Mojave Desert, has an elevation of 5,302 feet; the Tejon Pass, 5,285 feet; and Walker's Pass, 3,964 feet.

ARABLE LANDS.

The greater portion of the arable land of the county lies in the amphitheater formed by the Sierra Nevada and the Coast Range, joined by the San Emidio Mountains. In this area there are about 2,000 square miles, consisting of the bordering foothills and the lower portion of the valley known as the "delta"—the latter being very fertile and productive land, about 150,000 acres of which are covered by the irrigating systems. About 55,000 acres of this area are in alfalfa.

The foothills bordering the base of the mountains and sloping down to the valley have an elevation of 800 feet up, and are mostly valuable for grazing purposes. Being in the thermal belt, wherever water can be obtained, this portion of the valley is suitable for the cultivation of lemons, oranges, and other tropical fruits, beets and all kinds of vegetables for early shipment to Eastern markets.

Formerly, before the waters flowing into the valley were diverted into artificial channels and used for irrigation purposes, the overflow formed Kern and Buena Vista lakes and the swamp and overflowed lands along Buena Vista a slough to Tulare Lake. Since the development of irrigation works, these lakes and bordering swamp and overflowed lands have disappeared. Buena Vista Lake, being now limited by a system of levees, is used as a reservoir in which is stored the surplus waters of Kern River which, during flood periods, are not used in the irrigating canals. This reservoir has an area of 25,000 acres, and has a holding capacity of fifty billions of gallons.

IRRIGATION—WATER-SUPPLY.

There is a very elaborate and well-constructed system of irrigation, by means of which all of the water, except in flood periods, is diverted upon the agricultural lands, with profitable and satisfactory results.

Upon this system of canals and distributaries has been expended, in construction, about five millions of dollars. It consists of over 1,100 miles of laterals and 300 miles of main canals—these main canals varying from 10 to 32 miles in length, and from 10 to 80 feet in width on the bottom, with capacities varying from 20 to 900 cubic feet per second.

The Kern Valley Water Company's canal, used as a wasteway in flood periods, leading through the low lands toward Tulare Lake, is 175 feet in width, and has a capacity of about 6,000 cubic feet per second. The canal leading into the reservoir is 4,000 feet in width, with a capacity of 6,000 feet per second.

The only resource in water, worth mentioning, in this county, is Kern River, which rises among the highest peaks of the Sierra Nevada Mountains, in the northeastern part of Tulare County. This river flows through 35 miles of one of the grandest cañons of the Sierras. It enters the valley a few miles above the city of Bakersfield, and has a catchment area of 2,383 square miles. The river has a mean discharge of about 900 feet, and a discharge of about 3,000 feet during the principal irrigating season, from the 1st of May to the 20th of July.

In the lower portion of the valley artesian water is obtained at a depth of from 300 to 900 feet. In some localities the wells discharge as high as 5 cubic feet per second. In other localities only a small flow can be obtained. What is known as the "Artesian Belt" covers about 100,000 acres.

In all portions of the delta lands, and in some localities in the high lands, an abundant supply of surface water can be had at a depth of from 12 to 40 feet. By means of cheap power this water can be raised to the surface for irrigation at a trifling cost.

The irrigation systems in use are now supplemented by wells and pumping plants operated by means of the power generated in Kern River cañon, and transmitted by electricity. These pumping plants are capable of raising 100 cubic feet of water per second, demonstrating the possibilities of successful irrigation by means of wells where cheap power can be obtained.

The irrigated portion of the valley is adapted to the production of a great variety of fruit, all kinds of cereals, and particularly to the growth of alfalfa, or "lucern," which produces as high as fourteen tons of hay per acre in one season. Alfalfa, as a forage plant, is unsurpassed, and will grow continuously without reseeding for fifteen years. It will maintain two cows to the acre.

HORTICULTURE.

Kern County sends out to market apricots, peaches, pears, plums, prunes, nectarines. apples, quinces, pomegranates, olives, figs, grapes, raisins, almonds, English walnuts, oranges, lemons, and all kinds of berries. and melons; celery, asparagus, cabbage, cauliflower, sugar-beets, potatoes, corn, pumpkins, and all other vegetables of whatever variety.

The oranges and lemons raised in Kern County are superior to any produced elsewhere in the State, and mature several weeks earlier than the oranges of Los Angeles County.

Scale is entirely unknown in this county. There is much unoccupied orange, fruit, and vegetable land available at a low price and on easy terms.

There are many mountain valleys where cereals are produced without the aid of irrigation, and well adapted to the raising of the hardier kinds of fruit, which always finds a ready market at remunerative prices. These mountain valleys furnish homes to a great number of people, who utilize the mountain lands for grazing and dairying purposes.

Kern is rapidly taking a front place among the fruit counties of the State. She is especially favored for this purpose in soil and climate, and a great many landowners are already making plans for setting out large tracts to orchard the coming season. It is therefore probable that the present season's record will be greatly exceeded in the very near future.

STATISTICS.

Kern County has a population of 18,000. Assessed acreage, 2,793,605 acres. Total assessed valuation, $21,000,000. The present tax rate is $1.50 per $100.

PRECIOUS METALS.

Kern County has extensive and valuable mineral resources, producing borax, mica, copper, gold, silver, lead, antimony, iron, sulphur, Fuller's earth, lime, gypsum, and petroleum. In the Mojave Desert, in this county, are some of the most productive gold mines in the State, there being producing mines in Randsburg, Roderick, Goler, and Summit mining districts—all situated in the Mojave Desert, within the boundaries of Kern County.

On Greenhorn Mountain, and in the vicinity of Kernville, are many producing gold mines, and many very promising mines awaiting development, with indications that discoveries of valuable deposits of gold and silver will be made from time to time.

OIL-FIELDS.

New discoveries are daily being made, enlarging the area of the proven oil-producing territory.

The daily shipment of oil from the Kern River, McKittrick, and Sunset fields amounts to about 5,000 barrels, produced from wells which yield from 50 to 400 barrels a day. There are many wells which flow continuously. The oil territory is so large that it is not probable that the demand for the oil will equal the possible production within a period of fifty years, making it certain that for a long period of time Kern County will have the cheapest fuel and the cheapest power of any place west of the Rocky Mountains. At prices at which fuel oil is likely to rule, power can be produced at a rate less than a half cent per horsepower per hour.

The possibilities suggested by this state of facts must be left to the imagination.

In the history of Kern County the year 1901 has been remarkable, witnessing a hitherto unknown development, a fact due chiefly to the immense fields of oil discovered a short time previously.

A total of 198 wells has been drilled in the Kern River district, and an increased output, which would be still larger were it not for a car shortage, is recorded. The shipments for November were 2,460 carloads. In the opinion of well-informed operators, the greatest possible yield of the district is fully fifty per cent above the latest figures.

Some twenty miles of pipe-line have been laid by the Standard Company alone in this field, and probably an equal length by operating companies. These latter have all increased their storage facilities, and the Standard has erected, and is erecting, thirty-five tanks, with a capacity of 35,000 barrels each. Kern River field improvements for 1901 amount to about $1,500,000.

In addition, the Union Oil Company has begun the foundations of a refinery, which will have a capacity of 1,800 barrels daily. The Pacific Refinery in Bakersfield is about completed, at a cost of $50,000. It contains three 600-barrel stills, and will be in operation as soon as a pipe-line can be run from the wells.

The McKittrick oil-field has increased the number of its wells during 1901 to the extent of twenty-nine, not counting the failures. The town of McKittrick has grown with the oil development, and is twice its size of a year ago.

The Midway oil-field has a history confined to the past year. Last March the first strike was made, and four wells have since been completed. The Canfield & Chanslor water-pipe-line has been finished, at a cost of $50,000, and the one great drawback to speedy development has been removed.

The Sunset oil-field contains forty-nine wells, two thirds of which were drilled during 1901. A railroad, the Sunset, has been built, connecting the district with the Southern Pacific's branch line to McKittrick at Gosford. It is forty-two miles in length, and its reported cost was $500,000.

RAILROADS.

There are two transcontinental railroads passing through the county, with branch roads running to the Sunset and McKittrick oil-fields.

ELECTRICITY.

The power plant located at the mouth of Kern River cañon, operated by the Power Development Company, is one of the best equipped and most reliable installations of the kind in the world. It furnishes light and power to the city of Bakersfield, and to many pumping plants in the outlying country.

There are other power plants being installed to utilize the water power available in Kern River cañon, which will furnish 18,000 horsepower, and other schemes are in process of development to make available almost unlimited power in the falling waters of Kern River.

THE CITY OF BAKERSFIELD.

Bakersfield, the county seat, and distributing point for the county, is a prosperous and growing city of 8,000 inhabitants, with public library, twelve churches, four school buildings, opera-house, oil exchange, and many finely equipped halls and meeting-places of various fraternal societies. There are four banks, five newspapers, steam laundries, foundries, machine shops, planing-mills, tank factories, packing-houses, flouring-mills, refineries, oil plant, gas and electric-light plant, and fine county buildings, with many structures in contemplation. There is a system of sewerage, six miles of street railway, and an elaborate waterworks plant, supplying the purest and most wholesome drinking water found in the State of California.

CLIMATE.

The climate of Kern County is similar to that of the interior region of California—the lower valleys being quite warm in the summer time, and the higher or mountain portions furnishing any temperature that may be desired. In twenty-four hours, the trip can be made from the valley to an elevation in the mountains where there is perpetual snow.

The warm period is from the 15th of June to the 15th of September. Although the thermometer goes as high as 110° for a few days in each year, sunstroke is unknown. The dryness of the atmosphere with its cooling effect makes the heat of California less oppressive than the same temperature in the more humid atmosphere of the Eastern cities. The nights are always pleasant.

AGRICULTURE—DAIRYING.

Cereals are largely produced, both in the valleys and on the higher levels. Wheat-growing is the leading industry of Tehachapi. Barley, oats, hay, and rye are raised to some extent, and Indian corn is extensively cultivated in the valley, growing to an astonishing size. Alfalfa is the standard feed crop, growing on the irrigated lands with unsurpassed luxuriance, and yielding from three to seven crops a season, of two tons at each cutting to the acre.

Cattle, horses, sheep, and hogs can be pastured with profit during the entire year on alfalfa. Either green or cured for hay, the nutritive qualities of alfalfa are surpassed by few other plants, red clover not exceeding it in protein or muscle-forming elements. Farm animals of all kinds relish and thrive, and in many instances actually become quite fat, upon the dry hay alone, and cows kept upon it demonstrate its value for milk-making in both quantity and quality of product. A proper stand of alfalfa furnishes a great quantity of extremely valuable and much-relished pasturage for swine and horses during a large part of the year.

Among the most profitable industries of the county is the dairy business. The climate is so mild that cattle can be kept out of doors all the time, and by breeding at the right season the cows can be made to give plenty of milk at the time of year when butter is highest. There is no portion of the State of California that has greater possibilities for becoming the greatest dairy district in the United States than that portion of Kern County located in what is termed the Kern Delta.

The following are close estimates of the number of acres of the different cereals sown for the year 1901:

	Acres.
Wheat	100,000
Oats	1,500
Barley	35,000
Corn	2,000
Hay	35,000

The rich, irrigated soils are well adapted to hops, tomatoes, melons, and all varieties of vegetables.

STOCK-RAISING.

Stock ranks, in Kern, among the greatest sources of wealth. Thousands of head of stock are raised on the rank feed of the plains. In addition to this, there is a large extent of natural range. The best blooded stock is found in this county.

The Antrim Stock Farm of Charles Kerr is devoted entirely to the raising of thoroughbred horses.

Henry Miller, the leading cattle king of the Coast, is one of the largest landed proprietors of the county. He numbers his stock of all kinds up in the thousands.

The Kern County Land Company raises all classes of livestock on a very extensive scale.

The poultry industry, while yet in its infancy, promises to become one of the leading and most remunerative ones of the county.

Raising of swine of pure breeds is profitably and extensively carried on.

The assessment roll of the county shows $14,000,000 worth of property, and gives the number of cattle as 65,000; hogs, 25,000; sheep and lambs, 1,000,000; Angora goats, 90,000.

TIMBER.

Aside from the heavy growth of oak in the foothills, useful for fuel, there are in the mountains large forests of pine, cedar, fir, spruce, and hemlock, extending the entire length of the county, and several sawmills are at work among them.

KINGS COUNTY.

Kings County, adjoining Fresno, is the youngest in the California sisterhood of counties, having severed from the mother county, Tulare, in 1893.

Practically the whole of Kings County is level land; the southwest corner barely touching the mountains. The center is taken up by Tulare Lake, which is nearly dried out, but at no time was it anything more than a shallow slough or sink, though there is a story that once upon a time a flat-bottomed steamer navigated its waters. The land made by the retreating of the water is not adapted to all uses, as it contains alkali, washed out of the surrounding territory by the many rivers and channels of rivers and main irrigating ditches with which the country is threaded.

The county has an area of 1,267 square miles, or 810,880 acres. Of this 612,522 acres are on the assessment roll, the valuation of the county being $7,500,000. Its population is about 10,000, of whom about one-third lives in the chief town, the county seat, Hanford.

With the exception of the old lake bottom, Kings County land is adapted to all forms of agriculture, and the district affords one of the striking illustrations of intensified farming.

The first settlers of the "Mussel Slough District," as the region along the Kings River slough was called, were farming people from the Middle-Western and Southern States, who came in emigrant wagons without capital. They selected these lands because the soil was rich and deep, and because plenty of water was obtainable for irrigation. There was no great corporation to construct an irrigation system for them, so they went to work with shovels and picks and built their canals and ditches. As a result, they own the water, and have no interest to meet. The cost of maintenance is light, averaging under 30 cents per acre per year.

The pioneer settlers are well-to-do, and hundreds of others who have come since the beginning, people of small means, or of no means at all, have earned places for themselves, from which they derive a steady, comfortable income. There are no very rich men, and no poverty class.

Another feature of the situation in Kings County, making it the more valuable as an illustration of intensified farming, is the variety of products. There are many sections of the State where a community enjoys a large income from one product, such as oranges or raisins, for example, but in Kings the farming is of a general character, and includes twenty or thirty different items.

The soil is alluvial in character, having been washed down for countless centuries by the Kings River and the slough, and deposited in fine silt, on which vegetation sprang up and decayed and then was buried under the wash. It is sandy and porous in quality, enabling the horticulturist to practice a form of irrigation that is rarely used. This is irrigation by seepage. Instead of flooding the land, the water is allowed to pass through it in ditches from one fourth to one half mile apart. This practice is less expensive and, where it is practicable, takes the place of fertilization and of deep plowing. As the soil is practically unlimited in its depth (for wells sunk to a depth of 1,000 feet show no variation in its make-up), there is no reason why this process should not be continued indefinitely.

The products of this county are fruits, green and dried; wheat, barley, corn, sugar cane, hay, alfalfa hay and seed, wine, livestock of all domestic kinds, cheese, butter, eggs, poultry, and petroleum.

The chief exports are grain, including wheat, barley, and corn, alfalfa, livestock of all kinds, wool, raisins (the annual export is nearly 400 carloads), prunes (there is one orchard of 750 acres), peaches, apricots, pears, apples, table and wine grapes, dairy products, nectarines, cherries, figs, almonds, wine, canned goods, vegetables. There is no county that produces such quantity and variety of material for export in proportion to the number of people.

The past year has been one of great progress, the dairy interests having taken the lead among the agriculturists. There are at present fully a dozen creameries doing a good business in the county, a majority of which have been established during the past two years. The Hanford cheese manufactory is one of the oldest dairy interests here, and it is flourishing, having never failed to pay a good dividend to the stockholders during the past twelve years, and its patronage extends from Riverside to Marysville.

There have been more farmhouses erected in Kings County during the past year than at any other time in the previous history, and the character of the buildings is modern. In the city of Hanford, upward of three hundred modern residence buildings have been erected during the past year.

The report of the Health Officer of this county shows a remarkably low death-rate for the past eight years, the average being but seven deaths per year per thousand population.

The business of the county is good; there is seldom a foreclosure for debt; there are very few criminal cases to require the attention of the court, and the county jail is practically empty. Immigration is brisk, and the county is being rapidly filled with a desirable class of people from the East.

Exports for the past year will reach approximately: Green fruits, 200 carloads; dried fruits, 2,200 carloads; canned fruits, 300 carloads; wine and brandy, 100 carloads; livestock, 1,800 carloads; 225 carloads of raisins, and 2,000 carloads of hay.

Kings County's population is increasing at a rapid rate, the population of Hanford, the county seat, having quadrupled during the past ten years. It now has a population of 3,500, and is a city with four banks, two daily and two weekly newspapers; a grammar school of sixteen departments; two railroad lines; a high school, having 250 pupils enrolled; electric light and power plant; a complete sewer system; a complete water system; free United States mail delivery; a business portion all built of brick made at home; a creamery plant; a cheese factory; a large fruit cannery, and one of the largest wineries in the State; a fine opera-house and all the necessary accommodations for seventeen secret and fraternal orders; fifteen churches; a public reading-room; foundry; machine shops, and several of the largest fruit-packing houses in the State. These industries are accompanied by the necessary adjuncts usually found in the liveliest communities.

LAKE COUNTY.

Lake County, which, on account of its scenic beauties, is named the Switzerland of America, lies about 100 miles north of San Francisco. Its boundaries are Napa on the south, Yolo and Colusa on the east, Mendocino and Glenn on the north, and Mendocino and Sonoma on the west. The county is about 75 miles long and 25 miles in width, and lies between two broken ridges of mountains, the Macayamas on the west, and the Coast Range, locally known as the Bear Mountains, on the east. It has an area of 1,078 square miles, or 689,920 acres, of which the larger part is mountainous. At the southern extremity is Mount St. Helena, at the northern Mount Hull, while in the center is located Clear Lake, a magnificent body of water 25 miles in length and 6 miles in width. It is from this that the county takes its name. This lake is situated at an elevation of 1,350 feet above the sea; the eastern shore is skirted by high mountains, but not abrupt, while at the center, on the western shore, it is almost divided into two lakes by Mount Konocti, or, as it is commonly known, "Uncle Sam," which rises out of the bosom of the lake to a height of 1,500 feet.

TOPOGRAPHY.

While Lake is a mountainous county, there are, nevertheless, a number of fertile valleys found ensconced among its hills. Some of these are of considerable extent and very fertile. Big Valley, which lies on the southwest shore of Clear Lake, comprises within its area 2,500 acres of first-class valley land, capable of producing all classes of agricultural and horticultural crops. The valley is well watered by three streams which pass through it, namely, Kelsey Creek, Cold Creek, and Adobe Creek. All of these streams take their rise in the mountains, pass through the valley and empty into the lake. Scott Valley lies along Scott Creek, in the center of the county, west of the lake, and contains about 7,000 acres of very rich land. Contiguous to the valley is also a large area of fine foothill land. Artesian water can be had anywhere in the valley at depths of 80 to 100 feet. Bachelor Valley, which lies north and west of the lake, contains about 3,000 acres of land, and is surrounded by low, open hills. Upper Lake Valley lies at the extreme north end of the lake, and embraces some of the best quality of land, much of which is under cultivation. Lower Lake Valley is at the south end of the lake, and is formed by the junction of Copsey and Seigler Creek valleys, forming a large and fertile tract. On the foothills surrounding this valley are found the largest and finest vineyards in the county. Coyote Valley, in the southern portion of the county, contains 15,000 to 20,000 acres of fine land, and is formed by the junction of St. Helena and Putah creeks. On the same creeks lies Loconoma Valley, separated from Coyote Valley only by a low range of hills, and being virtually a continuation of the same. Here are found some of the finest orchards and vineyards in the county. Burns Valley is small, but romantic and productive, and contains some beautiful residences. Cobb Valley is formed by the upper waters of Kelsey Creek, which takes its rise in Cobb Mountain. Besides these there are a number of smaller valleys, including the Capay, Clover, Donovan, Gravelly, High, Irwin, Jericho, Jerusalem, Long, Morgan, Paradise, Rice, The Twin, and others, all containing fertile land, capable of cultivation and heavy production.

CLIMATE.

The great charm of Lake County is its climate. The winters are never severely cold nor the summers oppressively hot. From November to April much rain usually falls, and ice occasionally forms in some places, but during this period there are days and weeks at a time when the sun shines brightly and the weather is perfectly delightful. Flowers usually bloom all winter, which is sufficient evidence of mildness.

From May until November the weather is always fine. But little rain falls, and though the summer days are warm they are not often sultry. A gentle breeze nearly always springs up in the afternoon, and though the evenings are sufficiently pleasant for one to sit out of doors until bedtime, the nights are usually cool enough to make a light blanket or quilt comfortable as a bed covering. Fogs are rare, and chilling winds almost unknown.

SOILS.

The valley soil of Lake County in general is a very rich alluvium of great depth and rare fertility. In the hills there is a larger admixture of gravel, but here in many cases the soil is from 10 to 12 feet deep and very retentive of moisture, rendering irrigation unnecessary.

CULTURAL PRODUCTS.

The resources of this county are mostly derived from the crops of wheat, barley, oats, corn, hops, hemp, and potatoes; from fruit, from sheep, goats, and hogs, and from the pineries and quicksilver mines. Wine-making is becoming an important industry, wineries being established at Lower Lake, Middletown, and on the northwest shore of Clear Lake. The best fruit lands are in the foothills. They are well watered, but as there is a sufficient rainfall to insure good crops no irrigation is necessary. All kinds of fruit do exceedingly well, especially the apple, pear, peach, apricot, plum, and prune. The Newtown Pippin apple, prized so much in the Eastern States and exported largely to England, grows to great perfection; pears likewise, the Bartlett pears from Lake County commanding a very high price in the San Francisco market. Lake County, however, is behind her sister counties of California as a fruit producer, but comparatively little attention so far having been paid to this branch of industry. Her soil and climate are well adapted to fruit, and with easier means of communication with the outer world there is little question but that horticulture would soon come into prominence. The principal fruits grown are apples, pears, and prunes. The market for these is to a great extent local, although a large part of the apple crop finds its way to San Francisco.

LIVESTOCK—DAIRYING.

The entire county offers excellent opportunities for all branches of livestock-raising, although this industry is not developed as prominently as it might be; but the outlook for a railroad, via Napa Valley, is assured in the near future, which will stimulate this industry by providing an outlet to markets.

Lake County is naturally adapted to the raising of Angora goats.

Dairying, principally for home consumption, is a profitable industry, and with railroad communication opened there is no finer field in California for this industry.

OTHER RESOURCES.

The timber resources of the county are extensive. There are large bodies of sugar pine, yellow pine, fir, cedar, and oak, practically as yet untouched.

Quicksilver is the leading mining industry of the county, although gold, silver, copper, and other minerals are known to exist.

Lake County has a large number of health resorts and mineral springs, among them being the celebrated Bartlett Springs, Allen Springs, Harbin Springs, and a number of others. Bottling of the waters of these springs for shipment has become quite an important industry.

LAND VALUES.

Prices of land vary according to location. First-class improved, near towns, from $100 to $200 an acre; land as good, unimproved, from $30 to $100. In general, the man of moderate means has excellent opportunities for securing a home in this county.

The last report of the United States General Land Office gives close to 400,000 acres as vacant, describing it as mountain, grazing, and timber land.

LASSEN COUNTY.

Lassen County is one of the most northerly counties of California, being separated from Oregon by Modoc County. It lies on the eastern slope of the Sierra Nevada Mountains, and is bounded on the north by Modoc County, on the east by the State of Nevada, on the south by Plumas, and on the west by Shasta County. Its southern boundary is very irregular, running in a southeasterly direction from Shasta to Sierra County, making its eastern boundary on the State of Nevada 105 miles in length, while the western boundary, on Shasta County, is not more than half that extent. Its area is 4,750 square miles, or 3,040,000 acres; of this there are 375,000 acres of valley land, 325,000 acres of foothill land, and the remainder is classed as mountainous.

TOPOGRAPHY.

The county is a succession of mountain ranges and valleys, and although in the central and eastern parts the hills seem to have been placed regardless of direction or order, the ranges have a general trend to the southeast and northwest. A ridge having an altitude of 8,200 feet, and called Diamond Mountains, makes the dividing line between Lassen and Plumas counties. Diamond Mountains form the southern side of Honey Lake Valley, which extends southeast and northwest a distance of 45 miles, with a width of about 15 miles. In the extreme northwest corner of the county lies Big Valley, a large stretch of agricultural land, extending into Modoc County and comprising in Lassen County about 75,000 acres. This valley is watered by Pitt River, Ash Creek, and several smaller streams. Long Valley lies in the extreme southeast of the county, contains for its size but little agricultural land, but is remarkable for its singular conformation. Its south side is a high and very heavily-timbered ridge, while the rise in the north is gradual and the country dry, timberless, and open. The valley is about 40 miles in length, but very narrow, having an average breadth of from 1 to 3 miles between Big and Honey Lake valleys, separated from each other and from the main valley by intervening ridges of various lengths. The last named valleys are very small, containing but few ranches, and are mostly occupied by the bodies of water from which they take their names. In the eastern-central part of Lassen County lie the Madeline Plains, a large level tract of land, and at an altitude of 5,300 feet. This plain appears to have been at one time the bed of a lake, and to have been formed to its present condition by some change of nature. It is about 35 miles long and 15 miles wide, and is covered with a dense growth of sagebrush.

CLIMATE.

There is a great contrast in the climate of the counties east and west of the Sierra Nevada range. In the northeastern portion of California, the seasons more nearly approach those of the Eastern States, but are not so severe. In Lassen County there are heavy falls of snow in the winter months, and heavy freezes are common.

The air is bracing and tonic, being at no time oppressive. The mercury rarely goes above 85° or 90°, 75° to 80° being the more common midsummer temperature at noon. The nights are always cool, but not affording excessive contrast with the day temperature noticed in portions of California.

The rainy season occurs the same as in San Francisco, the precipitation being about the same on the mountains. The precipitation varies with the altitude and the distance eastward from the Sierra. The Sierra plateau, above described, presents no western arresting wall against the moisture-laden clouds from the ocean, and the fall of rain and snow is every heavy, especially the latter. According to United States Signal Service maps, the average is nearly double that on the highest mountains of Los Angeles and San Bernardino counties. This melting snow supplies the irrigating water in Susan River, Willow Creek, Ball's Cañon Creek, and other streams and Eagle Lake, providing permanent and liberal irrigation for a vast area.

LEADING INDUSTRIES.

Agriculture is chiefly confined to the growing of barley, rye, wheat, oats, and potatoes, and large and certain crops are regularly secured. Alfalfa is extensively grown for hay for the winter feeding of stock; it is cut some three or four times in a season, and, under irrigation, will average six tons to the acre.

Clover, timothy, and other natural grasses grow very prolifically without irrigation.

Potatoes of a very excellent quality are grown, the yield being enormous, at times over 200 bushels to the acre.

Stock-raising is one of the leading industries. The ranges are excellent, bunch and other natural grasses furnishing plenty of feed during the summer. In winter the climate is somewhat severe and stock need shelter and feeding. Considerable stock is driven in from adjacent counties during the summer months to pasture in the mountains and smaller valleys.

The Madeline Plains are noted for their extensive and fine forage range, and horses for general purposes are chiefly raised; they are well known for their hardy and sound constitutions, being in great demand for the San Francisco and other markets and for army purposes.

Dairying is also a profitable industry, and several creameries with skimming stations are established in the valleys. The Honey Lake and other creamery butter is of a very high grade. Large quantities of butter are shipped regularly to San Francisco and other commercial points.

The apple-growing industry of the county is rapidly becoming very important and profitable. The apples grown in the county are of a very superior quality and are not excelled in flavor or keeping qualities by any grown in the Eastern or Northern States. They find a ready market and are in demand for export. A very high grade of cider is manufactured.

The production of poultry and eggs is quite large, and considerable shipments of both are made to outside markets.

Extensive systems of irrigation, with reservoirs and canals for the distribution of water, exist in most all portions of the county, insuring at all seasons a sufficient supply of water, and many thousands of acres of heretofore arid lands have been brought under cultivation.

The N. C. & O. R. R. connects the county with the main line of the Southern Pacific Company at Reno, Nevada.

There are close to 700,000 acres of valuable timber, consisting of yellow and sugar pine, fir, cedar, etc. As in the case of many Northern California counties, the lack of railroad facilities retards many possible profitable industries of this county.

While not, properly speaking, a very prominent mining county, considerable placer and quartz mining has been done at a profit. The quartz mines at Hayden Hill have been worked at a profit and now are producing considerable ore.

The county seat is Susanville, at which is located the United States land office of the district. There are several smaller towns in the county, but on the whole it is sparsely settled, the last United States census giving the population as only 4,511.

The report of the United States General Land Office of July 1, 1901, gives the area of unappropriated and unreserved land as 2,422,932 acres, describing same as timber, grazing, desert, and mineral.

LOS ANGELES COUNTY.

By the Chamber of Commerce, Los Angeles.

Los Angeles County is bounded on the north by Kern, on the east by San Bernardino, on the south by Orange County and the Pacific Ocean, and on the west by Ventura County.

In wealth, population, and resources Los Angeles is the most important county in Southern California, and ranks next to San Francisco in the State.

There are two rivers in Los Angeles County, one named the Los Angeles, the other the San Gabriel. During a large part of the year these are mere dry beds of sand, what little water they contain finding its way through the porous sand to the bedrock. In the winter months they are dangerous streams. The Los Angeles River rises in the western part of the San Fernando Valley, about 12 miles northwest of the city, and flows easterly 18 miles to the Los Angeles Pass. Its stream is fed all along by springs. Two other "rivers," the Pacoima and the Tejunga, join it in the San Fernando Valley. Turning south, it flows through the Los Angeles Pass, and on through the city. In former years its waters flowed through the southwestern part of the city, and out through the cienega district, and emptied into the ocean through La Ballona Harbor. Subsequently the river changed its course, and for years emptied its waters into the lowlands around Compton and Wilmington.

Los Angeles County embraces within its limits a great variety of scenery and climate. Within its 4,000 square miles of territory—an area almost as large as the State of Connecticut—may be found the climate and scenery of almost every part of the State, from the cool and breezy seashore to the warm inland plains and bracing mountain-tops. Of the area of the county, about four fifths is capable of cultivation, the remainder being mountainous. The shore-line is 85 miles in length. Nine tenths of the population is within 30 miles of the ocean.

The population of Los Angeles County, by the census of 1890, was 101,454. The population of the county by the census of 1900 was 170,298. The assessed valuation of property after equalization is $103,328,904. The marvelous growth that has been made by this imperial county during the past few years may be seen from the statement that, by the census of 1880, the population was only 33,881, while the assessed valuation, in 1882, was only $20,655,294. Thus, within the short space of twenty years, the population of the county has increased more than fivefold, and the assessed valuation of property in proportion. Great as this increase is, there are many conservative men who believe that the real growth of Los Angeles County has scarcely commenced; and the vast improvements that are provided for within the next few years warrant such a view of the future.

The chief industry of Los Angeles County is horticulture, the list of products including everything that can be grown in the State, and almost everything that can be raised in semi-tropic countries. The area of land within the county devoted to horticultural purposes is being rapidly extended, as the large tracts are subdivided and improved.

Los Angeles County is well provided with transportation facilities. A dozen lines of railroad center in Los Angeles City, tapping almost every section of the county, while coast steamships call regularly at the leading seaports.

Perhaps the most important enterprise for Los Angeles that has yet been commenced is the big breakwater now being constructed by the Federal Government at San Pedro, for which an appropriation of $3,000,000 was made by Congress. By means of this breakwater the depth of water over the bar will be so increased as to permit ocean-going vessels to come to the wharves, and Los Angeles will then be able to compete for its share of the growing Oriental trade. Other improvements, such as drydocks, wharves, and fortifications, will follow the harbor work. Other shipping points of the county are Port Los Angeles, near Santa Monica, and Redondo.

The rapid growth of Los Angeles County is shown by the statement that during the decade between 1890 and 1900 this county made the largest growth of any county in the State, namely, 67.8 per cent, the percentage of growth of the State at large during that decade being less than 23 per cent. The prosperity enjoyed by Los Angeles County is strikingly shown by statistics of the percentage of mortgage indebtedness to real estate values. These were recently, for the State at large, 12 per cent; for Los Angeles County, 5⅕ per cent. The figures for Los Angeles City and San Francisco are 5⅕ and 11½ respectively.

SAN GABRIEL VALLEY.

The San Gabriel Valley, which has always been considered a choice section of Los Angeles County, has the Sierra Madre range on the north. These mountains are grand and precipitous, inclosing the valley like a wall. This valley is undoubtedly the best known of any portion of Southern California. Even before there was any "boom" here worthy of mention, lands in the valley commanded a comparatively high price. As with most attractive sections, the level-headed mission fathers discovered its advantages, and founded the San Gabriel Mission—whose church is still in good preservation—in 1771. Now three railroads traverse the valley, and the land is rapidly being transformed into a succession of small homes and thriving little cities. The valley contains 100 square miles of territory. Under the shadow of the mountains, and separated from the lower plains by symmetrical foothills, the air is dry and bracing, proving beneficial to invalids who can not bear closer proximity to the ocean.

The San Gabriel contains some of the choicest fruit land in Southern California, and is largely devoted to the raising of oranges and lemons, as well as deciduous fruits.

Pasadena, a beautiful city of over 10,000 population, is located at the foot of the Sierra Madre range, about seven miles from Los Angeles. Within twenty years Pasadena has grown from a sheep pasture to a city of beautiful homes, with a world-wide reputation. Other settlements in the valley are Alhambra, Monrovia, Duarte, and Azusa, all of which are mainly supported by horticulture.

POMONA VALLEY—OTHER IMPORTANT SECTIONS.

Adjoining the San Gabriel Valley on the east is the Pomona Valley. Irrigation is cheaply supplied to this section from the San Antonio River, which comes down out of the cañon of the same name, a romantic spot, and a favorite resort for pleasure-seekers. The soil and climate of this section are peculiarly adapted to the culture of citrus fruits, which flourish here in great luxuriance. Railroad facilities are very good, and increasing, which has caused the valley to settle up rapidly. It contains a number of flourishing towns, the chief of which is Pomona, one of the most thriving cities of Southern California. For miles in every direction around Pomona extend continuous orchards of oranges, lemons, apricots, peaches, prunes, olives, and other fruit trees, a specialty being made of olive culture.

Other important sections of the county are the Los Nietos Valley, a well-watered district, noted for its corn, alfalfa, and dairy products; the stretch of country between Los Angeles City and the ocean, over which the city is destined to spread before many years; the San Fernando Valley, north of Los Angeles, in which a large amount of fine wheat is raised; and Antelope Valley, an elevated region in the northern part of the county, where land is cheap and, with water, very productive.

TRANSPORTATION FACILITIES.

Los Angeles enjoys railroad competition in the shape of three transcontinental lines, and work has commenced on a fourth, by way of southern Nevada and Utah, which will shorten the distance from Los Angeles to Chicago over 200 miles. This company has been organized by a syndicate of capitalists headed by Senator Clark of Montana, who have acquired the Terminal Railway as the Pacific Coast end of the new transcontinental line, which will open up to Los Angeles a section in southern Utah and Nevada that is marvelously rich in coal, iron, silver, and other minerals. The company is known as the San Pedro, Los Angeles & Salt Lake Railroad. The line of the Santa Fé system from San Francisco to Los Angeles is open. The coast line of the Southern Pacific to San Francisco by way of Santa Barbara is in operation. Altogether there are a dozen lines of railway centering in Los Angeles. The Pacific Coast Steamship Company runs vessels every few days from Los Angeles County ports to San Francisco and San Diego.

RAPID GROWTH OF VEGETATION.

One of the most attractive features about a home in this section is the wonderful rapidity with which vegetation of all kinds grows, so that instead of having to wait years for a new residence to assume a settled and homelike appearance, the owner only has to wait a few months until his house is surrounded with thrifty plants and climbing vines, while even some trees, as in the case of the eucalyptus, grow up to a respectable size from the seed within a year, and can be planted around the lot while less rapidly growing trees are attaining size, thus obviating the bare, hard appearance which attaches to new residences in less favored climates, however beautiful, architecturally, the buildings may be.

CLIMATE.

This is an "all-the-year-round" climate, pleasant in summer as well as in winter. There is none of the depressing heat or the insect pests which drive people from Florida as soon as summer commences. It is not an enervating climate, but bracing and full of electricity; a climate that makes the sick well and the strong more vigorous. The nights are cool, blankets being always needed.

Little information is to be gained from tables showing "mean average temperatures." A section which has a summer temperature of 120° and a winter temperature of 40° shows an average temperature of 80°; so also does a section which has a summer temperature of 85° and a winter temperature of 75°. The following table shows the average maximum and minimum temperature in Los Angeles for the twenty years from 1880 to 1900, the figures being furnished by the Weather Bureau of the United States:

	Max.	Min.		Max.	Min.
January	76°	34°	July	93°	52°
February	79	36	August	95	53
March	82	38	September	97	49
April	87	42	October	90	44
May	90	44	November	86	39
June	92	48	December	80	36

The lowest temperature recorded during this entire period was 28°, and during the entire period of twenty years there were only six months in which the temperature fell below the freezing point. Even on these occasions this temperature was maintained for only a limited time, generally in the early morning.

In considering the summer temperature, it should be remembered that the climate of Southern California is so free from moisture that, as stated, a temperature of 100° here is far more comfortable than one of 80° on the Atlantic coast. This is proven by the fact that farm laborers continue to work in the open fields during the hottest periods, while sunstroke is unknown.

On rare occasions during the winter months there are here and there light frosts, but never sufficient to damage mature semi-tropical trees. In the lower places, nursery stock of delicate trees and young growths are occasionally frosted, and such plants as the calla lily and banana are nipped. Again there are belts where peas, beans, tomatoes, and other vegetables grow all through the winter, while throughout the length and breadth of Los Angeles County the heliotrope, geranium, and jasmine blossoms shed their perfume from thousands of gardens in mid-winter. The constant suction of the prevailing winds from the ocean during the day and to the ocean at night, prevents the possibility of malarial conditions. In short, the climate of Los Angeles County is one that leaves a person entirely untrammeled, free to work or play in the open air almost every day in the year without having to give a thought to the weather.

Finally, it should be mentioned that the cyclones and tornadoes, which have been working such disaster east of the mountains during the past few years, are unknown in Los Angeles County. Thunder storms are occasionally seen in the mountains at a distance of from 15 to 50 miles, but do not visit the plains. It is not claimed that the climate of Los Angeles is perfect, but it may safely be asserted that it approaches as near to perfection as can be found upon the globe.

SOILS—PRICES OF LAND.

There is a great variety of soil, as well as of climate, in Los Angeles County, varying from light sandy loam to heavy adobe. The price of land also varies greatly, ranging from $30 to $100 per acre for lands adapted to grain, hay, and deciduous fruits, without irrigation, up to $250 or $300 per acre for first-class citrus lands, with an ample water-right. Land may be purchased in Los Angeles County on easy terms. A great many improved places, with bearing orchards and comfortable houses, are always in the market, there being here, as elsewhere, a considerable number of citizens who are never content to stay very long in one place, even though that place be as near perfection as can be found on earth. For those who have the means, it is often more advisable to purchase one of these improved places than to buy raw land and to improve it.

IRRIGATION FACILITIES.

The subject of irrigation is one that troubles many Eastern people who think of coming to settle in California, to judge from the inquiries that are received. A mistaken idea prevails to some extent, in the East, that farming is only carried on in Los Angeles County by means of irrigation, and that without it crops would be a failure. For all grains and winter crops irrigation is not employed. Corn is irrigated in some localities, being a summer crop, but is successfully grown in many places without irrigation. Upon some lands, after a crop raised without irrigation has been harvested, another is raised by means of irrigation. On irrigated land two or three crops a year are frequently raised. The advantages of irrigation are so manifest as not to need discussion. With an artificial supply of water, the farmer is rendered independent of the season's rain, while the product of his lands is enormously increased.

SMALL HOLDINGS.

One of the surprises to new arrivals in this section is the small amount of land that is needed to support a family. It is a fact that many families in Los Angeles County not only make a good living on five acres, or even less, of irrigated land, carefully tilled, but also manage to lay something by every year for a rainy day. In such cases the farmer raises most of the food products that are consumed by himself, his family, and his stock, and always has something to sell when he comes to town. Ten acres are, in fact, about all that one man and his family can attend to, if worked to their full capacity, and as soon as a settler begins to hire help the profits decrease very rapidly. Fruit trees can be planted on the land, between them small fruits, and then again vegetables, until the trees become too large. Under such circumstances there is a constant succession of crops.

THE COLONY SYSTEM.

A favorite method of settling land in Southern California, which offers many advantages, is the colony system. These colonies are made up, either here or in the East, among persons who are acquainted with each other, generally being residents of the same section. Each settler owns his ten, twenty, or more acres independently, but by purchasing the land at wholesale, in a block, a great saving is effected. The settlers can also coöperate in purchasing supplies, piping water, canning, drying, and otherwise preserving fruit, making olive oil, and marketing their products. Besides all this, they have the advantage of social life from the start, with schools, churches, library, store, postoffice, etc., which otherwise might be long in coming. They do not feel like "strangers in a strange land," and their land will increase in value twice as fast as it would were it settled in a desultory manner. Many flourishing towns started thus.

HORTICULTURAL INDUSTRY.

The development of the horticultural industry in Los Angeles during the past few years has been remarkable.

The most important horticultural product of the county is the orange. Besides the orange and lemon, the principal fruits raised in Los Angeles County are the almond, fig, prune, apricot, walnut, peach, pear, and berries.

The shipment of citrus fruits from Southern California points during the past season amounted to 24,100 carloads, of which 21,173 were oranges. A large proportion of these shipments were contributed by Los Angeles County. Deciduous fruits are shipped, fresh, canned, dried, and crystallized. As previously mentioned, an active demand for our dried fruits has grown up in Europe.

Each section of the county, as a rule, has some agricultural or horticultural product of which it makes a specialty, although in some sections almost every crop raised in Southern California is grown. In Los Angeles County the leading center of orange culture is along the foothills of San Gabriel Valley. Around Pomona, both citrus and deciduous fruits are raised, and a specialty is made of the olive. The lemon is raised at Whittier, in the San Gabriel Valley, and back of Long Beach, as well as in the Cahuenga Valley. The olive also flourishes in the San Fernando Valley, and the almond thrives in the Antelope Valley, where they have cold winters and land is cheap. The country around Downey is an all-round farming region, where large quantities of pork, butter, cheese, corn, and vegetables are raised. The walnut does particularly well around Rivera, just south of Los Angeles City. Strawberries are made a specialty at Gardena and at Azusa.

HAY—GRAIN—VEGETABLES—FLOWERS—HONEY.

Alfalfa, which is largely grown for hay, is a most valuable forage plant. It is cut from three to six times a year. Large quantities of wheat and barley are raised. Los Angeles County corn sometimes grows to a height of twenty feet. Pumpkins have been raised weighing over 400 pounds. There is a beet-sugar factory at Alamitos. Los Angeles honey is celebrated all over the country. In the neighborhood of Los

Angeles calla lilies, tuberoses, carnations, and other flowers are raised by the acre. Hundreds of acres are devoted to the cultivation of celery, which is shipped East by the trainload. Winter vegetables, such as string beans, tomatoes, green peas, and chile peppers, are shipped to the North and East during the winter months, realizing high prices.

DAIRYING—POULTRY-RAISING—OSTRICHES.

Until only a few years ago, most of the butter consumed in Southern California was imported from the North and East. This is no longer the case, a number of creameries having been established during the past few years, with most successful results. There is room for more.

Poultry does well in Southern California, when it is given the same attention it receives in the East. Eggs always command a good price, seldom falling below 15 cents per dozen, and running from that up to 35 cents or more.

In the line of big birds, ostriches are raised here for their plumes, and the industry is profitable. There is a large ostrich farm at South Pasadena, near Los Angeles.

LIVESTOCK.

Southern California is an ideal section for livestock. The horses raised here have been noted for their speed and endurance, from the time of the early Spanish settlers. Some famous thoroughbreds have been raised in Southern California, and it is the opinion of many that this section will one day rival Kentucky as a breeding-ground for fine horses.

GAME AND FISH.

Among the game found in Los Angeles County are wild geese, ducks, snipe, cottontail and jackrabbits, squirrels, foxes, deer, wildcats, California lions and bear, the latter being found in the northern part of the county, within 60 miles of Los Angeles City.

The angler finds plenty of trout in the mountain cañons. In the ocean there is excellent fishing, both with line and seine, and some remarkable catches are made. The yellowtail, ranging from 15 to 80 pounds in weight, is very numerous in the waters of the Pacific. The tuña attains a length of five feet or more, and a weight of from 100 pounds upward. "Jew-fish" are sometimes caught weighing 400 pounds.

MINERAL WEALTH.

Although Los Angeles County is chiefly noted as a horticultural section, its mineral wealth is by no means unimportant. Including petroleum, Los Angeles ranks fourth in mineral products among the counties of the State, and is the only county in California which leads in five mineral products.

Los Angeles is the center of a number of rich mineral fields in Southern California which last year yielded products to the value of about $14,000,000. The chief of these, exclusive of petroleum and asphaltum, were gold and borax. There were also produced, in smaller quantities, silver, clay, gypsum, granite, cement, lime, and a few other mineral substances.

The chief gold camp of this section is Randsburg, in Kern County, a short distance from the Los Angeles County line. During the past five years this camp has yielded over $5,000,000 in gold, and the production of that metal may be said to have hardly begun.

It was near the borders of Los Angeles and Ventura counties that gold was discovered in California, during the mission era, long before the discovery by Marshall at Coloma, which electrified the world. Some placer gold is still taken out in that section. Recently there have also been encouraging reports from gold quartz deposits in the Antelope Valley, in the northern part of Los Angeles County. For many years some gold and silver have been taken out in the Sierra Madre range, about 20 miles northeast of Los Angeles, but the formation there is so broken and the surface of the country is so covered with brush that prospecting is very difficult.

PETROLEUM.

One of the most remarkable features of development in Los Angeles County and Southern California during the past two years has been the greatly increased production of petroleum. For over twenty-five years petroleum has been produced on a limited scale in Los Angeles and Ventura counties, but it is only within the past few years since the discovery of a rich field within the city limits of Los Angeles that the industry has assumed great importance. To-day the petroleum industry of Southern California is attracting the attention of capitalists throughout the country. While development has been extended into other counties, Los Angeles still leads in the production of petroleum, having produced in 1901 nearly one third of the total product of the State, which is estimated at about 8,000,000 barrels.

The oil produced in California differs from that of the Eastern States, being of a heavier grade, with an asphaltum base, and it is used almost exclusively for fuel. It has been adopted by most of the leading factories of this section, and is used largely by the railroads. A careful test recently made with a locomotive showed that oil at $1 a barrel is equivalent to coal at $4 a ton.

It is evident that the development of petroleum in California is yet in its infancy. Oil is found throughout the entire length of the State, from Mexico to the Oregon line, although so far the most important and profitable development has been in and near Los Angeles County. There is every reason to believe that within a few years California will be the leading petroleum State of the Union, and that the value of the oil product will exceed that of the gold mines. Indirectly, the oil industry in Southern California has been of great benefit to Los Angeles, in stimulating manufacturing and furnishing a large amount of business to the machine shops and foundries.

MARKET PRICES FOR FOOD AND OTHER PRODUCTS.

There is probably no important city in the United States where most of the necessaries of life are more reasonable in price than in Los Angeles. The following are normal retail prices, for an average year:

Pears, 2 to 3 cents per pound; peaches, 2 to 3 cents; plums, 2 to 3 cents; apples, 3 to 5 cents; quinces, 2 to 3 cents; grapes, 2 to 5 cents; pomegranates, 4 to 6 cents; fresh figs, 2 to 3 cents; watermelons, 5 to 15 cents each; cantaloupes, 5 to 15 cents each; lemons, 15 to 20 cents per dozen; oranges, 15 to 30 cents per dozen; guavas, 6 to 7 cents per pound; blackberries, 5 to 10 cents; strawberries, 5 to 12 cents; raspberries, 10 to 15 cents.

Potatoes, $1.00 to $1.50 per 100 pounds; seed potatoes, a little higher usually; squash, 2 cents per pound; string beans, 3 to 5 cents; sugar peas, 4 to 5 cents; tomatoes, 3 to 5 cents; celery, 5 cents per bunch; sweet corn, 15 cents per dozen; cucumbers, 10 cents per dozen; egg plant, 5 to 10 cents each; carrots and turnips, 2 cents per pound.

Beef: Round steak, 12½ cents per pound; chuck, 10 cents; rib, 15 cents; sirloin, 17½ cents; porterhouse, 20 cents; tenderloin, 18 cents; rib roast, 15 cents; chuck roasts, 10 cents; leg of mutton, 12½ cents; shoulder, 10 cents; chops, 15 cents; lamb, 15 to 20 cents; veal, 10 to 12½ cents; roast pork, 10 to 12½ cents.

Fish, 10 to 15 cents per pound; oysters, 50 to 60 cents per quart. Oysters are imported from the north.

Butter, 30 to 35 cents per pound; eggs, 20 to 25 cents per dozen; chickens, 50 to 75 cents; ducks, 60 to 75 cents; turkeys, 18 to 20 cents per pound; rabbits, 20 cents.

Groceries are reasonable in price. Coal oil sells at 90 cents to $1.00 per five-gallon can; flour at $1.15 per fifty-pound sack.

Cordwood—eucalyptus, oak, or mesquit—is worth from $7 to $9 per cord, and coal from $8 to $10 per ton. Coal oil is largely used for fuel; also a distillate, made from Los Angeles crude petroleum.

Lumber averages from $10 to $20 per thousand for rough pine; $18 to $20 for rough redwood, and $27.50 to $35 for surfaced redwood. Pine is generally used for building and redwood for interior finish. Houses may be built for from $150 to $250 per room.

EDUCATIONAL FACILITIES.

The school facilities of Los Angeles are especially good. Besides the complete system of public schools, private schools and colleges abound in Los Angeles, Pasadena, and other towns. Many Eastern people avail themselves of the opportunity to send children with a tendency to weak lungs to a country where plenty of out-of-door exercise is a possibility every day in the year. Most of the leading religious denominations are represented, not only by scores of churches, but also by one or more religious colleges. The work of the school is further supplemented by an army of specialists in music, painting, and every department of art. The Chautauqua has an active membership of nearly a thousand, and meets annually at Long Beach. Lectures and other entertainments, by home and foreign talent, are of almost daily occurrence. The educational and social facilities afforded by Los Angeles are, in the widest sense of the word, unsurpassed. Public libraries are numerous and well stocked with the latest works.

PROGRESS OF THE PRINCIPAL TOWNS AND LOCALITIES OF THE COUNTY DURING 1901.

Burbank.—Deciduous fruits of tree and vine, alfalfa, grain, and watermelons were among the chief products of the year 1901 about Burbank. Of alfalfa, for which the soil, being free from alkali, is well suited, there were about 276 acres, averaging twelve tons to the acre for the year. The alfalfa sold at from $5.50 to $8 per ton. There were about 800 acres of deciduous fruits in bearing, most of the fruits being apricots and peaches. Many of the peaches weighed between twelve and sixteen ounces each, and sold for 2 cents per pound. From the deciduous-fruit orchards generally the yield averaged between five and seven tons per acre, and the fruit sold for from $14 to $20 per ton. The crop was less than normal, but was the best in three years. About 800 tons of wheat and barley were produced on about 230 acres. The grape crop aggregated about 1,000 acres, the yield being between six and ten tons per acre. Of walnuts there was a light crop, amounting to about twenty tons, the nuts selling for about 8 cents per pound. There were about 125 acres of watermelons. From one of the best fields the melons sold for $100 per acre. There was also a considerable production of oranges, almonds, and sweet potatoes. There are good opportunities for dairy and poultry enterprises. In one instance, $82 was cleared from five ducks and a drake, after deducting cost of feed. According to an estimate prepared by O. W. Seastrom there have been twenty-one wells put down, within three miles of Burbank, within the past two years, yielding an aggregate of 1,000 miner's inches by pumping. The water rises naturally to a level from fourteen to twenty-eight feet below the surface. Building improvements costing about $5,000 were made within the year. In November, 1900, the enrollment of the public school was 120. In November, 1901, the enrollment was 148.

Tropico.—The development of strawberry culture was one of the year's chief features about Tropico. There was scarcely a berry patch about there two years ago. Now there are sixty acres in the vicinity devoted to that small fruit, one third of the area having been planted within a year. The yield from those fields within the year amounted, approximately, to over $20,000. The discovery that subterranean streams can be tapped in the valley at depths ranging from 125 to 300 feet has resulted in a big increase in the strawberry output. A dozen wells have been sunk near Tropico, and streams amounting each to 50 miner's inches and less are being pumped, the quantity of water produced being limited usually by the capacity of the plants rather than by the amount available. About 25 per cent of the wells have been sunk within the year. The factory of the Pacific Art Tile Manufacturing Company, which institution was recently completed, has turned out some excellent experimental work, and promises to build up an industry unique on the Pacific Coast, giving employment to hundreds of people. The shipments of fruit from the Tropico station for the year 1901 to December 10th were: Oranges, 107 carloads; lemons, 32 carloads; wine grapes, 17 carloads. For the year 1900 there were 39 carloads of oranges and 4 carloads of lemons shipped from the same depot. Figures of shipments by the Salt Lake road are not available, but they would probably amount to 125 carloads of lemons and oranges, as the fruit from some of the largest orchards is sent by that route. Much of the fruit shipped from Tropico was grown about Glendale and in other parts of the valley.

Glendale.—A half dozen houses were erected within the year, and a number of the unoccupied ones left vacant by the collapse of the boom found tenants. A high school was established late in the year, and has thirty pupils. A general merchandise store and a lumber yard have shown an increase of 25 per cent in their business. There were a number of wells put down. The orange orchards yielded good returns, and from about twenty acres of small fruits a handsome revenue was obtained. From a large acreage of deciduous fruits, principally apricots and peaches, there was a heavy crop. Two or more fruit-drying plants were operated during the season.

Verdugo.—Of the wine grapes grown in the extensive foothill vineyards about Verdugo, there was a large yield, some of which was converted into wine at the Glassell and West Glendale wineries. The balance of the crop was hauled to Los Angeles. The small vineyards of table grapes proved profitable, and the acreage planted to those varieties was increased about 25 per cent within the year. There were a number of good wells sunk, and others are to be bored.

Eagle Rock.—The chief products of the Eagle Rock Valley were apricots, peaches, and tomatoes. The apricot crop for the past season is estimated as having yielded to the growers a revenue of $5,000. From about twenty-five acres of tomatoes a good crop was obtained. Most of the tomatoes were sold at the Los Angeles and Pasadena canneries, but there was a considerable quantity, grown on the southern exposure of the frostless hillsides, shipped to the Eastern markets. The water-supply of the valley comes from about fifteen wells, nearly all of which were sunk within the past two years. Their aggregate production is about 100 miner's inches.

Fernando.—About 215 carloads of oranges and 50 carloads of lemons were shipped from Fernando during the year. In 1900 the citrus-fruit shipments amounted to 102 carloads. The fruit grown about Fernando is free from scale or smut. A Pasadena company is about to set 450 acres northeast of Fernando to oranges, and has planted 50,000 nursery trees near Pacoima Cañon, where water is being developed. The olive crop from the 1,200-acre grove of the Los Angeles Olive Growers' Association was very heavy. There are in the grove 100,000 trees seven years old. According to an estimate made December 8th by a representative of the company, the crop, which was then only partly gathered, would amount to 1,500 tons. The company installed an oil and pickling plant at a cost of about $10,000. McClung & Powell harvested 20,239 pounds of Mission olives from 140 trees thirteen years old. The picking cost $15 per ton, and the olives sold for $32 per ton. There were 3,840 tons of wheat raised about Fernando and sent away within the year. Of barley there were 625 tons, and of hay 120 tons. Scarcely any grain or hay was sent away in 1900. From 190 colonies of bees on the J. F. Lynn & Son ranch, east of Fernando, 14½ tons of honey were sold at $110 per ton.

The Maclay Rancho Water Company is installing a water system, which assures abundant irrigation about Fernando. According to an estimate of H. J. Stocker, the chief engineer, the company has expended $40,000 on its plant within the past year.

On the Los Angeles Farming and Milling Company's ranches there were seeded about 27,000 acres, lying in the San Fernando Valley, between Burbank and a line a few miles from Chatsworth Park. From that seeded area there were produced 202,500 sacks of wheat and barley.

Chatsworth Park.—The past season's yield of wheat and barley grown within 7 miles of Chatsworth Park, not including that produced on the lands of the Los Angeles Farming and Milling Company, amounted to 50,000 sacks, according to an estimate of A. L. Phillips, most of the grain being wheat. Other products within the district were 600 tons of hay, 3 carloads of oranges, 500 tons of deciduous fruits, including 100 tons of apricots, and 30 tons of honey. The California Construction Company employs about 100 men at its quarry in getting out a part of the rock for the San Pedro breakwater. The company's Chatsworth Park payroll amounts to between $5,000 and $6,000 per month, and the output of rock from that quarry is about 20,000 tons per month. The tunnel which is to form a part of the Montalvo cut-off of the Southern Pacific Company's coast line, is under construction by Erickson & Peterson. The length of the tunnel, when completed, will be 7,369 feet. It will link the counties of Los Angeles and Ventura, the east end being about a mile from Chatsworth Park. Work is proceeding continuously from both ends. On December 1st the mountain had been penetrated over 2,000 feet from the east end, and over 1,500 feet from the west end. The work gives employment to about 325 men. The cost of the excavation is said to be between $650,000 and $700,000. The expense of timbering will also be heavy. The contractors hope to finish the work by March, 1903.

Newhall.—Otherwise than its oil productions, the chief sources of revenue about Newhall for the year were stock and deciduous fruit. The Newhall ranch of several thousand acres, which was formerly devoted to grain-producing, is now occupied with stock-raising. There was a large output of beef cattle within the year. The apple crop was a large one.

Antelope Valley.—The wheat crop of Antelope Valley, most of which crop was shipped from Lancaster, amounted to 20,000 sacks. Little wheat was raised in that district in 1900. The year's hay output amounted to 2,000 tons. A number of wells have been put down about Lancaster within the year, there being an area of six miles square where an artesian flow may be produced. The acreage of alfalfa has been largely extended where water has been developed. The almond crop was also an important item of revenue.

The year's output of beef cattle raised about Elizabeth Lake was a large one. There are in the vicinity 125 acres of apple trees ranging from six to twenty-five years old. The trees are free from pests. The vineyards cover 300 acres.

The reservoir at Harold Station, into which water is taken from Little Rock Creek, for the supplying of the Palmdale colony, is better stocked with water than it has been before since its completion, three or four years ago. The experimental sugar-beet farm at Palmdale looked well during the year, and is considered as encouraging to the prospect of the establishment of a beet-sugar factory. The Alpine Plaster and Cement Company established its plant at Palmdale within the year, and it is now in operation there.

Between 15 and 20 tons of almonds of the past year's crop were shipped from Manzana. The almonds from that ranch took the premium at the Atlanta fair. From the apple orchards, covering about one hundred acres of trees, from three to twenty years old, a good yield was obtained.

Pasadena.—Municipally the year has seen Pasadena develop from a city of the sixth class to one with a special charter. This charter and the city's progressive Mayor and Council have enabled the people to procure, by an overwhelming vote, $300,000 bonds for public improvements, including parks, new city hall and jail, better streets, increased sewer system and municipal water experiment. The city has these improvements well under way.

The census of 1900, the last one taken, gives Pasadena and suburbs 9,117 inhabitants. The secretary of the Board of Trade, who made last year's school census, is certain that there are many more people here now than then, because at that time hundreds of houses for rent could be found, while now it is very difficult for newcomers to rent houses.

The Pasadena Ice Company's plant, a mile south of the business section, near the Santa Fé Railroad tracks, is the only new manufacturing establishment built during the year. It has an output of 15 tons of artificial ice daily. The Pasadena Novelty Works absorbed the Wakeley Novelty Works, and manufactures quantities of Southern California souvenirs.

As Pasadena is preëminently a city of homes, the fruit industry is maintained principally in the outskirts. During the season of 1900 the Pasadena Orange Growers' Association shipped 82 carloads, and 106 carloads during 1901. The Earl Fruit Company shipped about a like amount. One hundred and six carloads of oranges and lemons, and 16 cars of dried fruit were shipped by the Pasadena Deciduous Fruit Association. Numerous small shipments were made. The Pasadena Packing Company enlarged and improved its facilities, and could scarcely find help enough to handle fruit at its cannery.

Pasadena Suburbs.—San Gabriel township, including the settlements of Alhambra and San Gabriel, in which a number of wealthy people have made their homes, has a population of about 2,400 people, according to the last census. There is somewhat of a boom in real estate in this section, owing to the projected electric railway connecting with Los Angeles and Pasadena. A subsidy of $10,000 was raised by citizens to secure this accommodation, and the company has promised that within two months the cars will be running. More real estate has changed hands during the past few months, since this project was fairly started, than during the whole previous year. About 1,200 carloads of oranges and lemons were shipped during the year.

South Pasadena has a population, according to the last census, of 1,001. The municipality has devoted its attention to the improvement of streets and to electric lighting, until it heads the list of small towns in this respect. Fruits are taken to Alhambra for shipment, but a local packing-house is now projected. South Pasadena's principal industry, the ostrich farm, is the largest in the world. It has just been doubled in size, and now has one hundred and fifty birds.

Pomona.—Pomona, the center of an increasingly rich agricultural section, now numbers about 6,500 people, the school census for 1901 showing 1,572 pupils. Four new brick business blocks have just been completed, aggregating over $50,000, and numerous substantial dwellings have been erected, so that the assessed property valuation of the city is now $2,250,000. Numerous citrus groves have been recently purchased by new arrivals, who have come to make their home here, and a considerable acreage has been planted to orange trees. The Irrigation Company of Pomona has just installed a $30,000 pumping plant. The estimate of this season's orange output for Pomona Valley is 1,500 carloads. The Board of Trade (J. Albert Dole, president, and C. B. Messenger, secretary) now has a membership of 300, and is doing excellent work for city improvement.

Glendora.—The palm for having packed and shipped the first carload of Navel oranges from California this season is claimed by Glendora. This shipment was made on October 17th by the A. C. G. Fruit Exchange, which organization packed a total of fifty carloads for the holiday trade. The Fay Fruit Company and A. Gregory have each just completed commodious combination orange and lemon packing-houses on the line of the Santa Fé. The total average crop is estimated at 400 cars. The excellent developments of the Glendora Water Company have furnished an abundance of water in this foothill locality, and irrigation is no longer a serious question for the rancher. The population is placed at 800, there being over 180 school children. There are now no vacant houses, and the Glendora Hotel has been reopened this winter to supply a growing need.

Covina was incorporated last July. The orange crop is figured at 1,200 carloads. Two new orange packing-houses have just been completed—one for the Spruance Fruit Company and one for the J. S. Kuns Fruit Company.

Azusa.—Adjoining Glendora on the west is Azusa, which estimates its present population at 1,400. The school attendance has grown to such an extent during the past year that the present accommodations are inadequate, and a new building is sorely needed. The railroad business has grown 20 per cent over last year, and it is estimated that the orange shipments will be 615 carloads. The Azusa Ice and Cold Storage Company's plant has been enlarged and the output increased.

Duarte.—General prosperity pervades the Duarte orange-growing district of 700 people. There are this year 160 school children, amply provided for in a commodious school building. The water-supply is now adequate, by reason of the active development of the past two years. Productive orange groves are the rule, and the orange estimate is placed at 400 carloads. A large business is done in the sale of orange trees. The Leary ranch, 1,400 feet above sea-level, has been purchased by physicians, who will establish a sanitarium.

El Monte and Puente.—The country adjacent to El Monte is being settled more and more with a substantial class of people, and the community is improving. Thirteen carloads of walnuts were shipped from El Monte this season. The potato crop was exceptionally large, and it is estimated that there will be 250 carloads of cabbage, 80 carloads of celery, and 45 carloads of cauliflower. At Puente there has been a good hay and grain crop, and the oil operations continue about as usual.

Whittier and Vicinity.—The oil industry and the horticultural interests were the chief sources of the year's revenue about Whittier. The amount per month paid out in wages on account of the oil industry in that vicinity is reckoned at $25,000. A large proportion of the men employed have families in Whittier, and make most of their purchases in the town. Last season there were shipped about 200 carloads of oranges and 150 carloads of lemons. The vegetable shipments for the year amounted to about 30 carloads. The present season's citrus crop is estimated as 150 carloads of oranges and 200 carloads of lemons. There are about 300 acres of oranges and 250 acres of lemons. Within two miles of Whittier there are 2,000 acres of walnuts, which, for the past season, netted the growers about $100,000. In 1900 the same groves netted the growers $80,000. About 200 acres more will be set out to walnuts. In November, 1901, the total high school enrollment was 62, and of the other grades of the public schools, 461. The number of teachers then employed was 14. In November, 1900, the high school enrollment numbered 50; that of the other grades, 431, and there were 12 teachers employed. The population of Whittier in 1900, according to the Federal census, was 1,680. The present population, according to an estimate of the Whittier Board of Trade, is 2,750. The site of Whittier fifteen years ago was a barley field.

Downey.—Within the year, based on figures for eleven months and an estimate for December, the Downey Coöperative Creamery received 4,094,404 pounds of milk, from which were made 107,343 rolls of butter, which sold for $55,845. In 1900 there were received 4,627,560 pounds of milk, from which were made 116,335 rolls of butter, which sold for $60,191. The receipts and proceeds for the last four months of 1901 were well ahead of those of the corresponding period of 1900. Of last year's orange crop about 100 carloads were shipped away from Downey. This season's crop is estimated at 75 carloads of superior fruit. A large part of the walnuts handled through the association packing-house at Rivera came from the Downey district. The local winery handled nearly 1,000 tons of grapes. Nearly three miles of flumes, costing about $4,000, were laid in the walnut irrigation district. Four brick blocks were built at a cost of $13,500, and other building improvements were made at an expense of about $14,500. There is in the vicinity a considerable acreage of sweet potatoes. From one ten-acre piece there were taken about 100,000 pounds, which sold at an average of about 1½ cents per pound. From about 100 acres of watermelons a big crop was taken.

Norwalk.—Sugar-beets yielded handsome returns to the husbandman about Norwalk. There are 171 acres devoted to sugar-beet culture, from which there were sold 2,234 tons of beets, the whole sum received by the growers for the beets being $9,774. Within two miles of Norwalk there were raised within the year 500 tons of grapes, a considerable part of which quantity was handled through the local wineries, the growers receiving from $14 to $16 per ton. About 4,000 pounds of milk per day was handled at the local creamery, a considerable part of the neighboring milk product being taken to the sterilized cream factory at Buena Park. Building improvements made within the year cost about $2,000. About 300 inches of water was developed by pumping. The litigation in which the Little Lake Ditch Company had been engaged for several years was settled within the year, and about a mile of flume was put in by the company. There is a flow of about 300 inches of water in the flume, from which flow nearly 3,000 acres of land that has during the past three years suffered materially for lack of water, may be irrigated. Two rural free mail delivery routes, extending over about 38 miles, are being established.

Los Nietos.—There were about 1,000 acres in the vicinity of Los Nietos devoted to alfalfa, under irrigation. The yield averaged nearly 7 tons to the acre. Water amounting to 200 inches was developed by pumping. The walnuts grown in the vicinity were handled chiefly through the Los Nietos and Ranchito Walnut Growers' Association. The present crop of oranges is believed to be about two thirds the quantity raised last year.

La Mirada.—From the 600 acres of olive groves in the vicinity a large crop was obtained. The trees are mostly seven years old. The manufacture of one of the products of grape-fruit yielded a considerable revenue.

Artesia.—There were about 300 acres of grapes within 1½ miles of Artesia. The crop, which was lessened by a late frost, averaged about 4 tons per acre, and the growers received an average of between $14 and $16 per ton. The Artesia skimming station handled about 6,000 pounds of milk per day, for which the patrons received $1 per 100 pounds, on a basis of 4 per cent butter-fat. There were about 100 acres of sugar-beets, which averaged not far from 15 tons to the acre. The beets were rich in sugar, and yielded the growers an average of $5 per ton. Apple trees one year old planted on the alkali soil have a thrifty look. Building improvements made in the neighborhood cost about $3,000.

Rivera.—Most of the walnuts produced about Rivera and neighboring towns were marketed through the Los Nietos and Ranchito Walnut Growers' Association, which has its packing-houses and headquarters at Rivera. According to the official report for the past season the association handled 35,920 bags, or 3,974,067 pounds of walnuts, for which the association received a net return of $335,702. The total expense of handling the crop was $1,894. In 1900 there were handled 27,803 bags, or 3,019,162 pounds of nuts, for which there was received a net return of $274,157. The expenses of handling that crop amounted to $1,696. The association has about 4,700 acres in bearing. About 250 carloads of oranges of the crop of 1900–1901 were packed and shipped from Rivera. About 200 carloads of walnuts were sent from Rivera, not all of which were from the Walnut Association. The year's new houses and other building improvements cost about $15,000.

Santa Fé Springs.—Grain, hay, pumpkins, lemons, and oranges were the chief products about Santa Fé Springs. For the milk from a herd of sixty cows, C. B. Woodhead received from the creamery within the past year a revenue of $4,200. The Santa Fé Springs sanitarium is under new management.

Compton.—From about 1,000 acres of sugar-beets in the vicinity of Compton the year's shipments amounted to 304 carloads. About 50 carloads more were shipped from Lynwood. The growers received $4.25 per ton, on a basis of 15 per cent sugar. The industry returned over $42,000 to the community for the season. From the extensive grain fields about Compton the yield was not far from fifteen sacks per acre, the crop being an average one.

At the Compton cheese factory there were received within the past year 5,869,677 pounds of milk, from which were made 686,720 pounds of cheese, which yielded to the patrons $73,427, basing the figures on the record for ten months, and an estimate for November and December. The milk came from 900 cows. Patrons received an average of $1.28 per 100 pounds of milk containing 4 per cent butter-fat. In 1900 there were 6,450,328 pounds of milk received at the factory, and the cheese output was 721,427 pounds. The sum paid to patrons was $71,044.34. The creamery northeast of town also handled a large quantity of milk. Buildings put up in the vicinity within the year cost about $20,000. Two rural free mail delivery routes were established, aggregating fifty miles in length. The apple production amounted to about 250 tons, for which the growers received from $32.50 to $35 and upward per ton.

Florence.—Sugar-beets have forged to the front among the chief items of revenue to the ranchmen about Florence. From the beets grown on 250 acres of the Cudahy ranch, over $10,000 was cleared. The aggregate area of the other beet fields about Florence is 600 acres, the yield on those lands being about the same as on the Cudahy ranch. There are 60 acres of walnuts in the vicinity, from which nearly fifty tons of high-grade nuts were taken. Nearly 1,000 acres were set out to walnuts. Great quantities of garden truck were raised in the neighborhood, and sold in Los Angeles. The water-supply on the Cudahy ranch was increased from 250 inches to 500 inches, the water being obtained by pumping. Dairy interests were extended, and there was some increase in population. A dozen buildings were put up at a cost of about $10,000.

Clearwater.—Nearly thirty carloads of sugar-beets were shipped from Clearwater within the past year. There were 400 tons of hay produced in the neighborhood. About 1,000 pounds of milk and 50 gallons of cream are shipped away daily, the milk shipments having commenced late in the year. Thirty tons of fresh fruits in small lots were sent to Long Beach and Catalina Island in the summer months.

Gardena.—Notable results in strawberry culture were obtained about Gardena. In 1900 the strawberry fields covered 150 acres, which area within the past year was extended to 175 acres. Nearly all of the berries were sold through Harry Robson. Figures furnished by him show the total sales for the eleven months ended November 30th, to have been 21,698 crates of berries, which, after deducting freights, commissions and costs of packing, yielded the growers a net revenue of $29,966.50. Newton Cowles raised three crops of strawberries on the same vines. About 1,800 sacks of peas grown near Gardena sold for $1.25 per sack. About $18,000 was paid to patrons of the Gardena creamery. In 1900 about $14,000 was paid. About 380 acres are in alfalfa, being an increase of 100 acres over last year's acreage. From C. E. Wallins's eight-acre piece, which is probably a fair sample, 10 tons per acre were taken, and it sold at an average of $7 per ton in the field. From three pumping plants, installed at a cost of $3,000, 200 miner's inches of water is developed. Building improvements made within the year near Gardena amounted to about $10,000.

Inglewood.—Among the year's products shipped from Inglewood were over 100 carloads of barley, 200 carloads of brick, and over 125 carloads of other produce. A considerable part of the products was shipped away by teams. From wells sunk by Charles Freeman, near Hyde Park, 125 inches of water is obtained by pumping, from which is, or will be, irrigated 300 acres not irrigated before. An area of several thousand acres southwest of Inglewood is about to be irrigated by the Artesian Water Company. The alfalfa acreage was within the year extended from 150 to 450 acres. The devotion of 15 acres to strawberry culture is one of the direct results of the extension of the irrigated area. From 10 acres devoted to calla lilies, and 2½ acres occupied with fresias, many bulbs were shipped East.

Moneta.—Most of the year's output of tomatoes, peas, and berries, which are the chief sources of revenue about Moneta, was handled through the Moneta Canning Company, which marketed the produce in Los Angeles when prices were high enough, and canned it at other times. There were 60 acres of tomatoes which yielded seven tons per acre, the growers receiving from $6 to $7 per ton. Scarcely any tomatoes were raised about Moneta in 1900. There were 125 acres producing two crops of peas, or one crop of tomatoes and one of peas. The yield of peas for each crop was sixty sacks of seventy pounds each, for which the growers received about $75, making a revenue of $150 per acre for the two crops. The conditions about Moneta are especially favorable to the production of peas of superior quality. The company also handled the strawberries grown on 100 acres. The acreage will be enlarged in the coming year. Twelve wells were put down, the largest being the one sunk by Williams & Cochran, from which 175 inches of water was developed by pumping, and from which 800 acres may be irrigated.

Hynes.—Fifty carloads of tomatoes, which quantity was nearly double that for the previous season, were shipped from Hynes. The tomatoes were grown within three miles of the place. The creamery received 20,000 pounds of milk per day, cream being brought also from the skimming stations at Bixby and Artesia, the former having been established within the year. The creamery company made improvements costing $4,000. Other building improvements made in the vicinity cost $2,500. The equivalent of 15 carloads of hay and 2,000 sacks of corn was raised in the neighborhood and shipped by wagon and rail.

The Palms.—Nearly 400 acres of alfalfa was irrigated within the past year from the new water-system of the Artesia Water Company. The other products under irrigation were principally beans, corn, walnuts, grapes, and garden truck, covering an area of 500 acres. Those lands had not previously been under irrigation. The walnut groves cover 200 acres. The trees, which are seven years old, appear to be doing so well that other groves will be set out in the vicinity. The dairy interests have been considerably extended within the year. The well northwest of the postoffice is reported to have penetrated oil sand between the 430 and 520-foot levels. It is expected that a rural free mail-delivery route, twenty-one miles in length, will be established soon. Building improvements made within the year aggregate $12,000 in value.

County Farm.—Of the oranges raised on the County Farm, as the county almshouse establishment is known, there were 22 carloads shipped away last season. At the end of November it was believed that this season's crop would amount to 25 carloads of fruit of unusually good quality. About $3,000 was cleared from last season's crop. There are at the farm 100 head of cattle, of which 65 are milked, the milk and butter being used for supplying the inmates of the farm and of the County Hospital. Of swine there are 50 thoroughbred Poland-China brood sows. The pigs within the past year cleared $1,200, which was more than for the previous year. There are 800 chickens supplying eggs for the farm and hospital. The number of inmates is 190.

Workman.—Although the acreage under cultivation about Workman within the past year has been about the same as in 1900, the production has been considerably greater. There were shipped away 30 carloads of sugar-beets and 12 carloads of potatoes.

Hollywood.—There were some 10 miles of streets, 100 feet wide, improved as boulevards, about Hollywood within the year. There were about twenty houses built, at a cost approximating $45,000. Not far from $10,000 was expended in laying out and beautifying the grounds about the elegant residences in that district. Two new greenhouses were built for growing vegetables under glass, the houses costing about $7,000. From one $1,400 greenhouse the products of four and one half months' work were sold at wholesale for $1,300. The seventh year of pineapple-raising in the valley has marked further success in that culture. Several hundred trees bearing the cherimoyer are from five to ten years old, and the production of that fruit promises to become a considerable industry. Many rare tropical shrubs and plants have been set out about Hollywood within the year.

According to an estimate prepared by G. F. Grass, there were over 200 acres bearing winter tomatoes, the land yielding to the growers from $275 to $375 per acre. There were 135 acres of winter peas, yielding a revenue of about $135 per acre for that crop, and additional returns for melons and cucumbers raised during the remainder of the year. There were about 15 acres of winter egg-plant, which in many cases paid $300 per acre. An area of 65 acres was devoted to winter string beans, which yielded returns about the same as from the peas. There were about 60 acres of chile peppers, which sold for from 5 to 37 cents per pound, and which gave rather larger returns per acre than the peas. The estimate made includes the lands along the foothills east of Sherman, but does not include about 100 acres of tomatoes and 60 acres of peas west of that town.

Colegrove.—The rapid enlargement of the operations of the Cahuenga Valley Lemon Exchange has been one of the chief items in the year's progress at Colegrove. The size of the association packing-house at Colegrove has been doubled, so that it now occupies a ground space 102 x 176 feet. That improvement, a part of which has two stories, cost $2,300. An addition, 40 x 102 feet, is soon to be built. The output of the exchange for the year ended August 31, 1901, was 161 carloads of lemons, of 312 boxes each. The output for the year ended August 31, 1900, was 76 carloads of 312 boxes each. The area of lemon groves tributary to the exchange is about 400 acres, being 60 acres more than a year ago. The trees range from five to ten years of age. The exchange during the past year employed from eighteen to forty men, the payroll ranging from $200 to $450 per week. Electric-power pumps and other machinery were installed at the packing-house at an expense of $400.

Considerable quantities of asphaltum have been taken from wells on the Hancock ranch, near Colegrove. The oil, which is very heavy, is pumped by a compressed-air process, and sells for $2.50 per barrel.

Veterans' Home.—There have been planted on the home farm within the past year about 40 acres of barley for forage, and 80 acres of corn, beets, and squash; the two latter being raised chiefly for hog feed. The home orchards have kept the tables well supplied with a variety of fruit. The yield of figs, in particular, was very abundant. The number of hogs is kept up at all times to between 600 and 700 head, affording a liberal supply for the home table. Fifty head of Southdown sheep have been added to the home stock, and their number is to be increased. The home garden has produced for the table over 300 tons of vegetables of every variety, except potatoes, which are purchased under contract, and over 50 tons for hog feed.

While a number of improvements are now under way or have been completed within the year, no large appropriations for needed buildings were allowed. A barrack commenced in 1900 was completed and occupied about July 1st. An additional wing to the hospital was also completed. Besides these, the construction in various directions, exclusive of general repairs, has aggregated an expenditure of $17,343, the principal items of which are the construction of an addition to hospital dining-room, $10,939; ammonia compressor, installed in power-house, $3,075; cold-storage plant for canteen (now in course of construction), $2,900; cement gutters and drainage in park, $2,000.

Attention is to be given to the beautifying of the park, for which $1,000 was recently expended in the purchase of several thousand choice trees and shrubs, comprising fifty varieties, which are being set out under the supervision of J. Campbell-Johnston, of Garvanza. Several miles of pedestrian paths form part of the contemplated landscape improvements of the park. The veterans are arranging for the erection of a large aviary at their own expense.

The total membership of the home on December 11th was 2,641, of whom 734 were on furlough. There were also living at the home 79 civilian employés and others, making a total resident population of 1,988. The mortality for the year to December 11th numbered 144.

San Pedro.—The lumber receipts at the port of San Pedro for the year 1901 were greater than in any previous twelve months in several years, if not in the town's history. The list of woodstuffs brought by vessels from northern ports, from January 1st to November 30th, inclusive, and discharged over the San Pedro docks for distribution through Southern California, Arizona, and New Mexico, includes 142,627,070 feet of what is classed as lumber, 1,492,500 lath, 56,438,650 shingles, 1,208 piles, 2,483,000 shakes, 16,417 posts, 395,296 ties, and 2,395 poles. Computed in feet of lumber, the quantity contained in a piece one foot square and one inch thick being reckoned as one foot, the receipts for the eleven months aggregated 163,125,270 feet. The estimated quantity for December was 18,000,000 feet. The total receipts of woodstuffs for the year 1900, by the same method of computation, were 125,957,561 feet. The lumber traffic about the port employed approximately 400 men during the year, most of them receiving $2.25 per day of nine hours' work.

At the end of November there had been delivered on the Government breakwater site 449,929 tons of rock. At that time the trestle from which the rock is dumped had been completed 3,792 feet from the westerly end of the breakwater site, and the substructure with a top surface 38 feet wide at the level of mean low tide had been about completed for 2,816 feet from the westerly end, and rock had been dumped several hundred feet beyond. About thirty men are regularly employed by the contracting concern, the California Construction Company, in unloading the rock, and more are engaged when the trestle building is in progress. The company's payroll for its San Pedro operations ranges from $2,000 to $4,000 per month.

The Union Oil Company delivered at its East San Pedro tanks 65,000 barrels of oil, piped and hauled by rail from the Whittier and Fullerton fields, and shipped it north by vessels, within the year.

The quantity of fish shipped away from San Pedro and East San Pedro within the year, based on the records for ten months, was 1,816,430 pounds. The quantity shipped away in 1900 was about 1,550,000 pounds. Exclusive of the other fish shipments the California Fish Company packed at its East San Pedro cannery, and shipped away, 18,000 cases of sardines. That company made improvements in its packing and fishing plant at an estimated cost of $12,000. The San Pedro Fish and Ice Company manufactured 800 tons of ice within the year. The lobster-packing plant received 100 tons of lobsters. The plant was not established until late in the year.

Long Beach.—Building improvements completed in Long Beach within the year were accomplished at an aggregate cost of $345,000. Among the most important items were the Coughran Block, $30,000; Hotel Riviera, $30,000; Barstow Hotel, $20,000; Stafford Block, $17,500; grammar school, $14,000; Park View Hotel, $12,500. There were eight other business buildings costing $45,000. There were twenty-three houses costing $2,000, or over, amounting to $58,000. There were also ninety-nine houses costing $90,500. Repairs and small buildings cost $27,500.

The Alamitos Beach Water Company sunk a twelve-inch well to a depth of 760 feet, four miles northeast of Long Beach. The well yields a natural flow of 250 inches of water, and it is expected the flow will be increased to 350 inches by pumping. The company has let a contract for $12,000 worth of piping. Electric street-railway franchises sold by the City Trustees within the year yielded $17,915 to the municipal treasury. A contract was let recently for nearly $2,000 worth of fire-fighting apparatus. The pleasure wharf was repaired at an expense of $4,194.40. The construction of a stone pier in place of the present pile structure is contemplated. There were 50,000 lineal feet of streets graded within the year, at an average cost of 60 cents per foot. There were laid about 200,000 square feet of cement walks, at an average cost of 10½ cents per foot. There were 40,000 lineal feet of cement curbing put in, at a cost averaging 33 cents per foot. Northeast of town, near Burnett, there are about 15 acres devoted to flowers and berries. The area will be extended for the coming year to cover 25 acres. The largest guava field in Southern California, a five-acre piece, is situated near there.

The United Electric, Gas, and Power Company installed a gas plant and laid about 15 miles of mains. The company also installed an arc-lighting system for street illumination. In conjunction with the Seaside Water Company the company contemplates building a power-house which, incidentally, is to supply hot salt water for the $100,000 plunge bath-house soon to be commenced. The Long Beach Gas Company expended about $6,000 in improvements and extensions in connection with its new gas plant. The school census of 1900 showed for the Long

Beach district 728 children of school age. The census of 1901 showed 867 children of school age.

The population of Long Beach in 1900, according to the Federal census, was 2,252. The present population, based on the volume of postoffice, banking, and other business, is estimated at 3,000.

Obispo.—Eight stills were added within the year to the plant of the Sunset Oil Refining Company at Obispo, increasing the capacity to 2,000 barrels of crude oil per day. The additional tankage made necessary by the increased capacity brought the cost of the improvement up to about $30,000. The plant is the largest oil-refining establishment on the Pacific Coast. The Globe Asphalt Company's works, operated in connection with the oil refinery, has a capacity of 40,000 tons of refined asphalt per year.

Wilmington.—The barley grown on the ranches back of Wilmington, and shipped away, amounted to 1,500 tons. The fish output, much of which was shipped away by teams, amounted to about 500 tons for the year. Fields covering 25 acres are devoted to the growing of flowers for the Los Angeles market, and bulbs for shipment East. A larger acreage will be devoted to grain for the coming year. About $5,000 was expended in building improvements.

Terminal Island.—Buildings constructed and other improvements made at Terminal Island within the year cost about $15,000. Attractive cottages are reaching out in the direction of Long Beach, and it looks as if the two places might become one. Plans are in contemplation for a solid embankment along the ocean front. The Gordon Arms hotel came under new management during the year. A yacht club was formed, and has already a good membership. With the completion of the Salt Lake road, Terminal promises to become a place of importance.

Santa Monica.—Buildings costing nearly $75,000 were put up in Santa Monica within the year, not counting those in the Ocean Park district. The Academy of the Holy Names cost about $17,500. The Episcopal Church was improved at an expense of $1,000. The Auditorium and incline walkway on the beach cost about $12,000, and $4,000 was expended on additions to the bowling pavilion. Thirty houses were erected at a cost of $40,000. There is a considerable number of buildings to be constructed as soon as the necessary labor and material can be procured. Bonds were recently voted for $35,000 for a City Hall, and for $25,000 for a bridge on Ocean avenue. The pumping station for the beach sewer system was installed under contract for $3,685. Street and sanitary improvements, including those in the Ocean Park district, embraced 11,000 lineal feet of grading, 15,600 feet of sidewalks, 6,300 feet of curbing, and 7,700 feet of sewers. Over fifty tons of honey were taken from the Santa Monica cañon and its branches.

The population of Santa Monica, according to the Federal census in 1900, was 3,057. The present population is about 3,500.

Ocean Park.—An immense building crop was the year's notable feature in Ocean Park, as the southern part of the city of Santa Monica is known. According to estimates, based on personal knowledge of the situation, and a house-to-house canvass, there were one hundred and nineteen houses built on the sands, costing less than $1,000 each, and aggregating $70,325. There were fifty-six houses costing $1,000 or over, and less than $2,000 each, built at an aggregate cost of $71,116. There were four houses, costing $2,000, or over, each, built at a total cost of $10,800. There were also built in Ocean Park, but not on the sands, about twenty-five other houses, costing approximately $14,375, and three store buildings, costing $2,400. The Hotel Holborrow cost $10,100, and the Casino cost over $10,000, $6,800 of that amount being for the building. Improvements made on the waterworks, and otherwise, on the Kinney & Dudley tract, cost about $18,500. The Ocean Park carnation fields were enlarged from five to ten acres, and over 500,000 flowers were shipped away. The new electric railway power-house is estimated as costing $25,000.

Port Los Angeles.—The list of merchandise received from vessels, and shipped from Port Los Angeles, by rail, in the eleven months ended November 30, 1901, includes 183,019 tons of coal, 8,478,611 feet of lumber, 205,050 railroad ties, and 14,901 tons of freight. In that period there were 3,283 tons of freight shipped by vessels. During the corresponding period of 1900 the receipts were 145,925 tons of coal, 6,199,134 feet of lumber, 11,876 tons of cement, 417,159 railroad ties, and 18,728 tons of merchandise.

Redondo.—The receipts of lumber from vessels discharging over the Redondo wharves in the past year, based on the record to the end of November, and the estimated quantity for December, amounted to 25,000,000 feet. That quantity exceeded the receipts for the year 1900 by about 100 per cent. For the year ended June 30, 1901, there were 11,530,000 pounds of grain received over the Redondo wharves. For the year 1901 there were 20,000 tons of merchandise of all kinds, except lumber, handled over the wharves. The quantity of fish shipped away from Redondo within the year, based on the record for eleven months, and an estimate for December, was 590,520 pounds. In 1900 the shipments amounted to 511,000 pounds. About 3,000 flowers per day were shipped from the Redondo carnation gardens. Four brick buildings were constructed at a cost of $12,500. The other buildings put up cost $6,000. The Pacific Coast Oil Company erected a 30,000-barrel steel tank for crude oil storage, with piping so as to discharge the oil into vessels in bulk at the dock. A large quantity of oil was shipped from Redondo by that company. Two miles of streets were oiled for dust-laying purposes. The Redondo Improvement Company doubled the power of its water-supply pumping plant. The same company is laying off a new beach city on the north beach front, where some important improvements are contemplated. The population of Redondo in 1900, according to the Federal census, was 855. The present population, according to an estimate of the Redondo Board of Trade, is 1,000.

Santa Catalina Island.—The year has been one of great prosperity for the island. Each year makes an increase in the number of visitors, but the percentage of increase for the past year has been far greater than for any previous year. Santa Catalina, from being a summer resort, has developed into an all-the-year-round resort; few of the Eastern winter tourists to Southern California fail to visit the magic isle. Already the winter business of the hotels exceeds that of the summer, in volume, and extensive additions and improvements are being made for the accommodation of the winter guests. The Hotel Metropole has added thirty-eight rooms to its capacity; has provided a ladies' café and billiard room; has constructed a dozen bay windows, reaching from the ground to the roof; has provided a dozen rooms in the older part of the house with private baths; has added forty-two feet to the length of the already large dining-room, giving a seating capacity of over three hundred; has constructed a grand promenade, or veranda, 200 feet long and 20 feet wide in the front of the hotel, and the wall separating the veranda from the office and parlor for almost its entire length has been removed and replaced with plate glass. The company has also installed an electric-lighting plant, which will light the entire village; and an elevator will complete the modern improvements to the hotel.

One of the most important of the plans of the year affecting the interests of Santa Catalina is the establishment of the wireless telegraph system on the island. The Pacific Wireless Telephone and Telegraph Company, with headquarters in Denver, is under agreement to install this marvelous system of communication between Avalon and Los Angeles, by January 31, 1902, which will place the island in communication with the world through this novel method.

MADERA COUNTY.

Madera County is bounded on the north by Merced and Mariposa counties, on the east by Mono, and on the west and south by Fresno. The county was organized from a portion of Fresno County in 1893. The assessed value of all property in the county at the last assessment was over $7,000,000. It has an area of 2,140 square miles, or 1,369,600 acres, of which about one half is on the assessment roll.

Probably half the county is good arable land, and as two streams of considerable size, the Fresno and the Cottonwood, and many smaller, flow across the county, it is possible to put all of this half under the ditch. A large part of the acreage of the plains is devoted to wheat-growing and stock-raising, for the original great ranches have not yet been subdivided for the small farmer. Fruit is raised, and alfalfa grown for dairy stock.

The dairy interest, although still in its infancy, has gained a firm footing during the past year. A skimming station, tributary to a creamery at Fresno, is well established at Madera, with an increasing business; and a large private dairy, with a very complete plant, has been created near Borden. Farmers are beginning to learn the advantages of the dairy business, and are rapidly seizing the opportunity.

Poultry-raising for outside markets is becoming a prominent and paying industry, the climate being especially adapted to it.

The climate and resources of the soil are very similar to those of Fresno, of which originally it was a portion.

Raisins do well and wine grapes are grown in quantities. Near the town of Madera are 1,000 acres surrounding a winery with a capacity of 2,000,000 gallons. Grapes are shipped to the Italian-Swiss Colony winery in tank cars from the neighboring country. It is a thoroughly equipped concern, having modern machinery capable of handling 300 to 400 tons of grapes a day, and a distillery that manufactures 200,000 gallons of brandy per year.

The most notable industrial movement during the year 1901 in Madera County has been the revival of lumbering operations on a large scale. This was brought about by the organization of the Madera Sugar Pine Company, a corporation that has expended something like $500,000 in establishing large sawmills in the pine belt, in constructing a box factory at Madera, and in connecting the two plants by a flume sixty-five miles long. This flume was that used by the old Madera Flume and Trading Company, which exhausted its timber several years ago, since which time the flume has been idle until the past year, when, after undergoing almost complete reconstruction, it began to bring down millions of feet of the finest kind of mountain lumber to railway connection. The effect of this activity has been marked, not only at the town of Madera, where there has been a very observable growth of population, but in the mountainous region as well.

A portion of the National Yosemite Park is in this county, and there are groves of big trees, besides beautiful scenery.

Gold and silver, as well as copper, are mined in the mountains; and a large smelter for the last named mineral is in operation in Madera. Near Richmond there is a large granite quarry, the product of which is in use all over the State. A match factory has recently been established.

Madera is a thoroughly wide-awake county, which is enjoying its full share of the wave of prosperity that is spreading over the valley.

The main lines of the Santa Fé and the Southern Pacific pass through the county, and there is also a branch line from Berenda to the station of Raymond, whence many passengers leave by stage for the Yosemite.

Madera, the county seat, is located in the southern portion of the county. Borden and Berenda are also thriving towns.

MARIN COUNTY.

Marin County is a peninsula separated from San Francisco by the Golden Gate, and approaching within a mile and a half of the latter county at its nearest point. It is surrounded on three sides by water—on the east by San Pablo and San Francisco bays, on the south by the Golden Gate and the Pacific Ocean, and on the west by the Pacific Ocean. Sonoma forms its northern boundary. Altogether Marin possesses a longer coast-line than any other county in the State. Its area is 509 square miles, or 325,000 acres.

The topographical features of the county are rolling hills and numerous small valleys. A part of the Coast Range crosses Marin in a northwesterly and southeasterly direction, and much of the surface of the county is broken and hilly, but a considerable portion immediately on the shore is composed of marsh and overflowed lands. The highest land in the county is Mount Tamalpais, which has an elevation of 2,608 feet.

SOILS.

The soil of Marin County varies from the rich adobe clay of the salt marshes, to the sharp, gravelly loam of the higher foothills. In the valleys it is composed of heavy black loam with an admixture of gravel; in the foothills a reddish loam prevails, sharper, and carrying less abobe. It is all easily worked, heavily charged with the elemental constituents of plant life, admirably suited to horticultural purposes, and wherever worked to fruit yields heavily.

Irrigation is not required. The depth of the soil, its retentive nature, and ample rainfall in the winter months, render artificial watering unnecessary.

CLIMATE.

Marin County has two distinct climates, which may be named the coast and inland climates. Between these there is a remarkable difference, and one that can hardly be realized when it is understood that they are separated from each other by a low mountain range scarcely three miles across. On the ocean side of this range fogs, chilling winds, and disagreeable weather are common, while on the inland side sunshine, warmth, and spring-like salubrity prevail.

On the inland side is San Rafael, the county seat of Marin, which enjoys climatic advantages unsurpassed in the State. Its nearness to San Francisco is apt to interfere with a just appreciation of its advantages in this respect, as those who are unacquainted with the facts can not believe that there can be so great a difference in the climate of two places so near together. Its range of temperature is not great, the air is dry, and during nine months in the year there is little if any wind. During March, April, and May there are occasional heavy winds.

The following tables of average rainfall, compiled from observations covering a series of years, will show the difference in precipitation at various points in Marin County, and also the months of the year in which rain is likely to occur:

PRECIPITATION AT SAN RAFAEL, CAL., FROM SEPTEMBER 1, 1875, TO JUNE 1, 1901.

Recorded at Bank of A. P. Hotaling & Co.

SEASON	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	August	Total	No. Days Rain
1875–76	.00	.15	11.25	4.69	10.42	10.84	11.21	1.15	.27	.00	.00	.00	50.02	56
1876–77	.45	7.35	.12	8.47	.00	.57	1.69	.05	.44	.05	.00	.00	19.20	35
1877–78	.00	.70	2.45	2.85	25.35	18.57	5.10	.81	.57	.00	.00	.00	56.42	73
1878–79	.55	2.99	1.38	.68	5.34	7.21	10.14	2.01	3.22	.00	.00	.00	33.50	44
1879–80	.00	.91	6.40	4.58	5.12	2.33	2.63	14.15	1.84	.00	.00	.00	37.92	59
1880–81	.00	.01	.33	18.67	14.63	4.48	.64	3.06	.04	.54	.00	.00	42.46	53
1881–82	.58	1.41	2.02	8.06	2.77	2.82	4.57	2.40	.32	.00	.00	.00	29.90	56
1882–83	1.84	6.72	6.09	3.09	1.66	2.52	9.07	2.95	6.16	.00	.00	.00	40.15	51
1883–84	.52	.89	.74	1.02	7.53	8.58	11.76	11.18	.35	2.03	.00	.00	44.60	65
1884–85	.15	1.39	.43	25.10	2.79	1.28	1.30	3.00	.01	.06	.00	.00	35.51	44
1885–86	.00	.39	10.76	6.88	12.26	.18	3.72	6.53	.73	.02	.00	.00	41.48	64
1886–87	.00	1.44	.67	4.06	2.67	16.59	1.14	3.46	.07	.00	.00	.00	30.10	41
1887–88	.21	.00	1.53	6.23	10.48	1.28	4.78	.03	.40	.48	.00	.00	25.42	45
1888–89	1.10	.00	7.46	6.97	1.34	1.13	10.78	1.26	3.49	.01	.00	.00	32.44	43
1889–90	.00	11.87	5.27	18.00	13.60	6.45	7.79	1.72	.97	.00	.00	.00	65.67	74
1890–91	.06	.00	.00	5.89	1.02	16.17	2.79	2.35	1.74	.14	.00	.00	30.16	44
1891–92	.35	.29	.51	8.63	5.47	4.59	3.87	1.88	3.85	.00	.00	.00	29.44	56
1892–93	.00	1.80	6.52	9.88	6.51	5.26	7.79	1.56	.45	.00	.00	.00	39.77	44
1893–94	.57	.17	3.14	3.03	10.83	6.85	1.24	1.27	1.60	.94	.00	.00	29.55	34
1894–95	1.80	4.68	.81	18.65	18.45	3.28	4.82	1.12	1.06	.25	.00	.00	54.92	54
1895–96	1.69	.00	3.37	3.99	19.87	.11	4.78	9.99	1.82	.04	.00	.00	45.66	46
1896–97	.35	3.07	8.73	8.54	3.00	8.80	8.82	.90	.61	1.65	.00	.00	44.47	36
1897–98	.00	4.19	2.22	3.24	1.80	8.18	.18	.45	3.14	.58	.00	.00	23.98	31
1898–99	.82	1.15	1.26	1.42	10.08	.79	10.07	1.82	2.30	.00	.00	.00	29.71	36
1899–00	.00	5.81	6.47	4.22	5.67	.76	3.19	3.14	.26	.00	.00	.00	29.52	37
1900–01	.66	3.74	3.21	2.95	7.29	8.66	1.28	4.68	1.66	.00	.00	.00	34.13	41

PRECIPITATION AT LAKE LAGUNITAS.

Lake Lagunitas is the Marin County Water Company's reservoir.

YEAR.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1880	8.71	4.64	3.35	30.75	4.62	.00	.00	.00	.00	.00	.47	23.97	76.73
1881	20.33	7.24	1.19	3.99	.12	1.13	.00	.00	1.10	1.49	2.92	10.87	50.38
1882	3.90	12.53	6.03	3.93	.24	.00	.00	.00	.95	4.93	8.35	2.47	43.33
1883	4.42	2.20	11.31	3.29	8.43	.04	.00	.00	.91	2.12	1.45	1.84	36.01
1884	10.05	11.94	15.55	12.95	.39	3.91	.00	.00	.75	4.60	.36	32.86	93.36
1885	3.56	1.73	1.62	3.17	.00	.00	.00	.00	.00	.89	24.24	9.88	45.09
1886	16.59	.57	3.75	18.39	1.92	.00	.00	.00	.00	1.83	2.40	11.36	56.81
1887	4.78	26.80	4.11	6.12	.24	.00	.00	.00	.13	.00	.96	9.32	52.46
1888	20.19	4.14	13.16	.18	.51	3.75	.00	.00	1.51	.00	11.88	14.11	69.44
1889	2.50	1.51	22.49	2.68	7.46	.12	.00	.00	.00	24.87	10.82	26.14	98.59
1890	20.84	10.10	9.85	4.35	2.33	.00	.00	.00	.19	.00	.00	8.08	55.72
1891	2.07	30.15	9.61	5.30	3.81	.71	1.74	.00	1.31	.84	1.26	9.49	66.29
1892	7.94	9.97	6.58	3.98	5.59	.00	.00	.00	.00	2.21	10.01	14.56	60.84
1893	8.60	7.59	18.11	4.25	.94	.00	.00	.00	1.70	1.57	12.99	8.53	64.28
1894	19.87	12.58	2.95	2.11	5.26	3.15	.00	.00	3.56	10.81	1.89	26.84	89.02
1895	40.22	8.98	10.21	2.50	3.77	.00	1.75	.00	3.98	.08	6.45	13.47	91.41
1896	44.25	.48	9.06	17.22	6.50	.00	.00	.06	.64	4.17	20.92	21.47	124.77
1897	7.34	11.87	14.05	.81	1.54	5.24	.00	.00	.04	5.61	5.09	8.71	60.30
1898	3.23	16.33	.84	.92	13.19	.00	.00	.00	.97	2.39	4.61	2.31	44.79
1899	29.74	.56	31.36	4.33	5.34	.00	.00	.00	.00	17.17	16.68	13.68	118.34
1900	15.38	2.10	9.80	6.53	1.35	.00	.00	.00	.47	7.62	8.51	7.88	59.64
1901	14.54	18.15	2.60	11.11	2.51	.00	.00	.00	2.32	2.90	12.72	7.11	73.96
1902	4.83	26.49	------	------	------	------	------	------	------	------	------	------	------

PRINCIPAL INDUSTRIES.

The principal industry of Marin County is dairying, but of late years attention has been paid to fruit-growing, and some land has been set to orchards. Some of the finest apples grown in the State are produced in Marin County. On the dairy lands of the Novato ranch there are ten orchards. On every rented subdivision of this, and the Burdell ranch, they are growing apple, pear, quince, fig, pomegranate, persimmon, apricot, peach, plum, and other fruit trees, the thrifty growth and large yield from which prove the superior adaptability of the soil and climate of this portion of Marin County to fruit-growing.

On the Novato ranch is one of the largest fruit orchards, including one of the oldest and most celebrated apple orchards, in the State. This orchard contains 250 acres, with 40,000 trees, of which 22,000 are apple, 2,000 apricot, 3,500 pear, and the remainder mixed fruits, including peaches, plums, cherries, English walnuts, almonds, and figs. There are also 200 acres of vineyard planted to Mission and Zinfandel grapes. The fruit from this ranch suitable for canning is taken by the Petaluma Canning Company. The apples are carefully sorted, and the best are packed in boxes and shipped to Australia, where they obtain the highest price, the reputation of this orchard being established at the antipodes. The smaller apples are used for cider and vinegar. Berries are grown to some extent and have proved profitable.

The land in Marin County is generally held in large tracts, and rented out for dairying purposes. It is very profitable in this way, and as a result there is but a sparse population, and but little advance is made in horticulture, although the greater part of the county is eminently fitted for this industry.

The DeLong orchard is the oldest fruit farm in Marin County. It was planted in 1857, and has been in continuous bearing from the beginning. No extensive amount of planting has been done in Marin County during the past year.

NUMBER AND VARIETY OF FRUIT TREES IN MARIN COUNTY IN 1901.

	Bearing.	Non-Bearing.
Apple	18,600	10,000
Apricot	6,500	900
Cherry	400	90
Fig	190	60
Olive	------	45
Peach	4,620	420
Prune	1,800	1,085
Pear	900	125
Orange	300	100
Almond	125	60
Walnut	50	25

The chief fruit section of Marin is around Novato, although there are young orchards distributed over the county.

MARIPOSA COUNTY.

Mariposa County is triangular in shape, and is bounded on the north by Tuolumne County, on the south and east by Fresno County, and on the west by Merced County. Its area is 1,543 square miles, or 988,000 acres, mostly mountains and foothills. The county reaches eastward from the edge of the San Joaquin plains across the foothills far into the Sierra Nevada Mountains, its altitude varying from 300 to 13,000 feet, Mount Dana, the highest point of land in the county, reaching an elevation of 13,227 feet.

The general topography resembles that of Amador, Calaveras, and El Dorado counties. There are about 300,000 acres of plains and lower foothills together, the latter predominating, and the balance consists of high hills and mountains; bare of timber on the plains, then scattering oak and scrub pines, then rising to immense tracts of sugar and yellow pine, fir, spruce, and cedar, and the giant sequoias of Mariposa Big Tree Grove, which contains some 427 trees, some of 35 feet in diameter and 150 to 300 feet high. The county is well provided with natural water in the Merced, Mariposa, and Chowchilla rivers, fed from perpetual snows. The famous Yosemite Valley is located in the eastern part of this county, at an elevation of 4,060 feet, with walls 5,000 feet higher. The Merced River flows through the valley. This famous valley has been too often and too graphically described to need detailed notice here.

The soil of the plains and valleys is black alluvium, and in the lower foothills there is a sharp, red admixture of adobe and gravel, all easily cultivated and good for grain and fruits.

The climate does not differ from that of Amador and Calaveras. Hot in the summer in the plains and lower foothills, and bracing and invigorating in the mountains. In winter it is delightful in the lower altitudes, while uninterrupted arctic weather prevails in the high mountains, with abundant and lasting snow.

Irrigation is practiced to some extent, water being taken from streams and mining ditches by private parties, and used with good results.

The county, outside of mining, is mostly devoted to grazing and stock-raising, not much grain and hay being raised. The cattle and sheep are ranged in the mountains in the hot summer and in the valleys and plains during the winter.

Considerable dairying is carried on during the summer months in the mountain valleys and a very high grade of butter is made.

The capabilities for fruit culture are precisely similar in range and quality to Amador and El Dorado counties, remoteness from market retarding development. All fruits grow finely; the orange, lemon, fig, olive, apricot, almond and walnut, peach, pear, plum, prune, and cherry in the lower foothills and protected valleys, the grape abundantly through the wider range, and the apple, of very fine quality, in the higher altitudes. Some of the best apples that find their way to the San Francisco market are produced in Mariposa County. An orchard of 1,500 trees planted by James Lannon in the Yosemite Valley has been bearing for years and with good results. The fruit is very large and handsome in appearance and the yield abundant. The principal fruit sections are around Coulterville, Jersey Dale, Darrah, and Grant's Springs. The orchards of Mariposa County are principally family orchards.

The agricultural and fruit interests of the county are steadily improving; thousands of acres are taken up by settlers every year, and there is yet considerable valuable land left for newcomers. Fruit-growing and poultry-raising promise to be very important industries.

The timber resources of this county are practically inexhaustible, only needing transportation for development. There are twelve saw mills working on local demands.

In former days Mariposa has yielded immensely in gold from its rich diggings. The county is seamed with quartz veins and only needs cheap freights to stimulate further development. The Mother Lode runs through this county. The quality of the ores is mainly like those of Amador County. Within the past year the mining industry has received an impetus which bids fair to place Mariposa in the front rank of the gold-producing counties of the State. The comparatively recent discovery of an extensive copper belt is also attracting the attention of mining men.

Mariposa, the county seat, is well built and provided with churches, schools, hotels, substantial county buildings and business houses, and the only newspaper in the county. Hornitos and Coulterville are mining towns. The absence of railroads retards development in the county.

The population, as given by the last census, is 4,720, being an increase of 1,000 over the census of 1890. There are over forty schools in the county.

The mountain streams abound in trout, the forests in game, and the resinous air of the pine-clad hills gives renewed health and delight in living.

The county has taken a new start this year. Agricultural or fruit lands range from $7 to $35 an acre.

MENDOCINO COUNTY.

Mendocino County is bounded on the north by Humboldt and Trinity counties, on the east by Tehama, Glenn, and Lake counties, on the south by Sonoma County, and on the west by the Pacific Ocean. Its area is 3,780 square miles, or 2,419,200 acres. It has 100 miles of coast-line. In general topography it is a mountainous county, with valleys lying between the mountain chains, or along the coast. It is one of the three great northern counties—Humboldt and Trinity being the others—that embody the greater part of the northern Coast Range Mountains, taking in their highest peaks, their deepest cañons, their fertile valleys, wooded slopes, rushing rivers, and picturesque scenery. Mendocino County shares with Sonoma, Humboldt, and Del Norte the glory of the great redwood belt of the world.

From north to south, this county has a length of 85 miles. Its width east and west is 45 miles. The Coast Range of mountains, composed of two parallel ridges, traverses the central portion of the county for its entire length. These mountains vary in height from 1,000 to 3,000 feet. Their lower slopes have a gentle declivity, while the higher portions are generally precipitous and furrowed with ravines and gulches. In the eastern and northern portions of the county many small productive valleys are found.

The Eel River, running north, and the Russian River, running south, both have their source in this county, and are the principal streams. A large number of tributaries connect with them; while down the slope of the western ridge large numbers of creeks, some of which might aspire to the dignity of rivers, find their way to the Pacific. It will be seen that Mendocino is well watered with the numerous streams which take their rise in the mountain chain that intersects her territory.

CLIMATE.

The climate of Mendocino County varies with altitude and proximity to the ocean. On the immediate coast heavy fogs and strong winds are common, while the interior valleys escape these to a large extent, and the extreme heat of the summer months is very greatly modified by their influence. During the summer the thermometer will reach the 100° mark and occasionally touch 10° beyond, but this is unusual. Like other portions of the coast, the heat is not oppressive, and work can be prosecuted without extreme discomfort, even during the hottest days. In the winter there are occasional frosty nights and mornings, and in exposed situations the mercury will sometimes, though not often, fall to 20° above, and it is recorded that on one occasion, in Round Valley, it fell as low as 17°. The temperature will give a mean of 80° for summer and 40° for winter. The rainfall is in excess of that of most of the counties of California, averaging 31.50 inches per annum.

SOILS.

The land upheaval which formed the Coast Range left between two of the mountain chains a string of lakes, which are, in their geographical position as you travel to the north, the valleys known now as Sonoma, Sanel, Ukiah, and Redwood valleys. Although the formation of these lakes is a matter of geographical history, their conversion into valleys is a matter of recent history. The erosion from the surrounding mountains filled these lakes with a deposit at a very early date after their creation; but the erosion has been deposited to such an extent during the last few years that the large trees situated at the bottom are in nearly every case buried many feet above their roots. If one will consider the original formation of these valleys, and will at the same time keep in mind what the mixture of certain soils will be when the natural chemical reactions have taken place, he will have no trouble in seeing in his mind the nature of the soils in Mendocino's valleys.

The land upheaval left the various strata of rocks which are found in all outcroppings. The erosion from the mountains washed down into the valleys and, mixed with decayed vegetation of the country, made a loam deposit which is very thick, varying from two feet near the foot of the mountains to thirty feet in the middle of the valleys. The soil which adjoins the loam deposit is what is known as black gravelly loam, mixed to a more or less extent with adobe.

Which of the two soils is the stronger is difficult to decide. The loam will produce more corn, while the black land will produce more and better fruit. Both will produce large crops of grain, but one will do about as well as the other.

Next back from the black soil is the hill land. The quality is uniformly a thick brown soil, which is lighter than the other two and drier. This last described soil is little cultivated at present, save in a few instances.

In Ukiah Valley there is the greatest variety of soil, even on a small tract. The river, and the many small streams which come from the mountains, have deposited sand, gravel, or alluvium. Speaking in a general way, there is a band of sandy loam along the banks of the river and larger creeks. Lying back of this and a little lower is a broad band of clay loam, very rich, but a little too rich for the best results. Rising still farther back is a sloping bench running to the hills, and oftener of light, yellow clay, and formerly heavily covered with brush. In some places this bench is deeply covered with coarse gravel. The lower hillsides are clayey and timbered. There are some large bodies of a black gravel formed by mountain streams, and this black gravel is the finest fruit land.

All of the best lands are under cultivation, and the benches will soon be cleared and tilled. Holdings are not large, 200 acres of valley land being an exceptional farm, and the tendency is to subdivision.

The soil in Yorkville Valley is a rich, black loam, and well adapted to the growing of vegetables, fruits, grains, and hops. The soil of the hillsides and mountains is well suited to the growing of grass, vines, and fruits, and in some places grain.

Anderson Valley is a long, narrow strip of land lying between two chains of mountains. It extends 17 miles southeast and northwest, and is from 1 to 2 miles in width. The soil in this valley is a rich alluvial, and well adapted to the growing of vegetables, fruits, and cereals. The soil of the hills is a rich, black loam, except in a few places, where will be found adobe and gravel.

In Potter Valley the soil is mostly a sedimentary deposit, but a variety exists—some clay, a small amount of adobe, and some of the lands so famous in other parts of the State for fruit-raising.

In Little Lake Valley the soil generally is a rich, sandy loam, but in a few places a black loam is found. The soil is very productive, and pays the tillers a liberal reward for their labors. Never in the history of the valley has there been anything approaching a failure.

PRINCIPAL AGRICULTURAL AND HORTICULTURAL INDUSTRIES.

The principal agricultural industries of the county are wool-growing, dairying, poultry and stock raising, and the growing of hops, grain and other cereals, potatoes, apples, and fruits of almost all descriptions. The wine industry is a very thriving one, and new vineyards are now coming into bearing.

Dairying is one of the leading interests, and within the county are located some up-to-date creameries, with numerous skimming stations. The butter produced is of a very high grade and finds a ready market.

Stock-raising, grazing, and wool-growing are very much in evidence. The Angora goat thrives well, the mountains being an ideal pasture for them. There are about 1,000,000 acres of land specially adapted for grazing purposes. The shipments of wool, of a grade second to none, amounted to over 1,000,000 pounds in 1901.

Hops are a very prolific crop and of the highest grade. Last season over 1,500,000 pounds were shipped out of the county.

Crops of wheat, oats, and barley are always certain, and over 1,000,000 bushels were produced last season.

Potatoes and apples of a very fine quality are raised and bring remunerative prices. The apples grown in the county excel in size and flavor the product of any other county.

The Bartlett pear, nectarine, peach, and fig are grown very successfully. Berries of all descriptions grow abundantly and are of large size and fine flavor.

In the near future, with better and cheaper transportation facilities, this county will surely press to the front as an all-round producer of most kinds of fruits.

Messrs. Burns & Waterhouse have recently secured a large tract of land in the vicinity of Hopland for a farm for the breeding of thoroughbred horses on a large scale. They have moved their stock, which includes some very promising young stallions and successful broodmares, from Rancho Del Rio, in Sacramento County. Next to the famous Rancho Del Paso, the property of J. B. Haggin, this firm is the largest breeder of thoroughbred horses in the State.

LUMBERING.

In the county are large tracts of redwood, covering over 600,000 acres, the lumber cut from which amounts to 100,000,000 feet annually. The California Redwood Company, with its mills located near Willits, and the Albion Mill Company, are the leading interests engaged in this enterprise. Shingles, boxes, and other lumber products are manufactured and shipped out of the county in large quantities. The shipments of tanbark alone amount to over $100,000 during a season.

Ukiah is the county seat, and is located on the California Northwestern Railroad. Recently the railroad has been extended to Willits, a thriving town thirty miles north. Hopland is a growing town, and there are several others located on the coast.

Most of the trade of the county is carried by vessels from coast points to San Francisco.

Land suitable for agricultural purposes, fruit-growing, etc., can be obtained at reasonable prices.

The last report of the United States General Land Office gives the total vacant land open to settlement, as over 737,000 acres, described as mountainous, timber, and grazing.

MERCED COUNTY.

Merced County is in the heart of the great San Joaquin Valley, and is centrally located in the State, being almost equidistant between the northern and southern boundary lines. It is bounded on the north by Stanislaus, on the west by Santa Clara and San Benito, on the south by Fresno and Madera, and on the east by Mariposa County. The greater part of its extent, which is about 90 miles east and west and 40 miles north and south, comprising an area of 1,968 square miles, or 1,259,520 acres, lies directly in the San Joaquin Valley, across which it extends from the foothills of the Sierra Nevada range on the east to the summit of the Coast Range on the west. In the northeastern portion of the county there are high foothills, increasing in height as they approach the higher lands of Mariposa County, where they merge into the high Sierra. On the southwest is the Coast Range, with rugged steppes, abrupt cañons, fertile valleys, and hills sloping to the plain, in the lower part of which lies the San Joaquin River.

TOPOGRAPHY.

With the exception of this small portion of the eastern part of the county, and that situated on the eastern slope of the Coast Range, the county is almost a level plain, broken only by watercourses.

The San Joaquin River passes in a northerly and southerly direction almost through the heart of the county. There are no precipitous banks to the river in this county, and during the high waters it frequently overflows its banks, inundating the adjoining country for a distance of some three miles on either side, twice each year. To the west of the San Joaquin River are the rolling, picturesque foothills of the Coast Range.

A large number of creeks take their rise in the mountain ranges on both sides of the valley. Most of these are torrents in the winter, only to become dry beds in the summer. Some find their way into the plains, and, where not diverted for irrigating purposes, become lost in the soil. Among the principal streams on the east side are the Chowchilla River, Bear, Black Rascal, Dry, Mariposa, Dead Man, Mills, Owens, and Dutchman creeks; on the west side are San Luis, Quinto, Los Baños, Cottonwood, Sycamore, and Wild Cat creeks. The principal stream, however, is the Merced River, which, having its source in Mariposa County, in the Yosemite Valley, runs the greater part of its course through Merced, flowing through the entire length of the county, and reaching the San Joaquin on its western border.

On the eastern side of the San Joaquin are the bottom lands and plain lands, skirted on the east by a narrow strip of low foothills, adapted to most classes of horticultural industry. The Merced river bottom has an average width of three miles, with an abrupt bluff on each side, and the soil is exceedingly fertile.

CLIMATE.

The climate of Merced differs little from that of its sister counties of the San Joaquin Valley. The summer months are hot, not usually oppressively so, although occasional days in the heated term are too hot for absolute comfort, but not too hot for fruit-drying, at which season they usually come. Frost is infrequent. The mercury will, in the winter, sometimes drop as low as 25° in some portions, but so low a temperature is the exception. This extreme low temperature may be expected in January, but never in any other month. The extreme heat in the summer occurs in July and August, when, for a few days in succession, the mercury may rise to 108° in the shade in the middle of the day. On account of the very great dryness of the atmosphere, the most extreme heat in the summer does not interfere with any farm or outdoor work. The rainy season commences anywhere from October to December. Snow sometimes falls in the higher foothills, but not frequently. Fogs are not common, and occur mostly in November and December. The average annual rainfall at the city of Merced is twelve inches.

SOILS.

The soils of Merced County vary with the locality. There are the alluvial lands of the bottom, a heavy reddish adobe loam mixed with gravel, a lighter chocolate-colored loam containing much gravel and sand, and a very sandy loam. The alluvial bottom land soil occurs over a large body of land in the southern as well as in the western part of the district. It is a comparatively late deposit from the Merced River, Bear Creek, and other smaller streams, dark gray in appearance, easy to work, and does not bake after irrigation; it is *the* soil for vegetables and grapevines. This alluvial soil is also easily irrigated, and holds the water well, and everything planted in it grows quickly.

The heavy, adobe-like loam is a direct wash from the foothills, and is principally found at their base. The color of this soil is dark brown, like chocolate, and it turns darker yet when irrigated. It contains a great deal of iron, and is rich in all constituents which promote plant life. When properly moist, and not too wet, it plows and cultivates easily, and pulverizes to a beautiful loam. This is the favorite soil for the orange and other citrus fruits, not only because it is a rich soil and contains much gravel, but principally on account of its location along the base of the hills, the very place where the thermal belt reigns supreme. This soil is also eminently suited for olives, and must as such be considered as the olive soil. Old olive trees grown in this soil are yearly loaded with fruit.

The third variety of soil is the very dark, blackish-red chocolate loam, very similar to the best of other soils of this character. It differs from this, however, in being more reddish, and it contains much iron. Like the adobe soils, it hardens if left alone after irrigation, but pulverizes readily if plowed or cultivated in time. As to location, this soil is also found at the base of the hills. Geologically considered, it is of older formation than the alluvial soils; in quality it is equal to the best soils anywhere.

A fourth variety is a light, sandy loam, easily worked and irrigated, which holds moisture well, and which abounds in soluble plant-food ready for the immediate use of the trees.

IRRIGATION.

Like most of the land in the San Joaquin Valley, irrigation is an absolute necessity over the larger portion of Merced County for the production of fruits, alfalfa, grain, and vegetables.

Two of the largest and most complete irrigation systems in the State are owned and operated in Merced County—one on the east side, the other on the west side of the San Joaquin River. The one on the east side is owned by the Crocker-Huffman Land and Water Company, a corporation with a capital stock of $3,000,000. The main canal comes out of the Merced River just above Merced Falls, where the company has constructed a large dam. The main canal is from 60 to 70 feet wide on the bottom, 100 feet wide on top, and 10 feet deep, the carrying capacity being about 4,000 cubic feet per second. The length of the canal is about fifty miles, with something over 200 miles of lateral or subsidiary canals built as part of the system, and these are being added to as demands require.

On the west side of the San Joaquin River, in Merced County, lies an immense irrigating canal, from which are watered tens of thousand of acres of the finest land in the valley. This canal was built by the firm of Miller & Lux. The canal is over 40 miles in length, and takes water from the San Joaquin River. Over a hundred miles of lateral ditches are maintained in connection with this west-side irrigation system, which has developed an otherwise dry section into an immense garden spot.

DAIRYING.

Considerable attention is now being given to the breeding of dairy stock, for during the last six years the dairy business has gone ahead with such rapidity that it bids fair to become the principal industry in the near future.

The best-equipped creameries in the United States are to be found in Merced County, and some of the recently-constructed ones are models of up-to-date factories.

Previous to 1895 no attention was paid to dairying. In August of that year a few of the farmers organized the New Era Creamery Company, the pioneer institution of the kind on the West Side. They put up a $5,000 plant. Within a year the business had outgrown the plant, and its capacity had to be increased. This has been its history every year since. Last year (1901) this creamery turned out 160 tons of fancy creamery butter. It must not be understood that this company has a monopoly of the business by any means. There are in addition three thoroughly-equipped cheese factories in this locality, while several of the large producers have their own separators and ship their cream to San Francisco.

The Fountain City Creamery, in Merced, has an ice and refrigerating plant, burns oil as fuel, and is lighted by electricity. The plant cost about $10,000, and can care for the milk of a thousand cows.

The several creameries (with skimming stations) located in this section turn out at present one ton of butter per day; yet the industry is only in its infancy, and is especially inviting to the progressive settler of moderate means, as a few acres intelligently and industriously handled will afford a good and sure income.

The great success of the creamery business in Merced County is not only based upon good markets and shipping facilities, coupled with thorough manufacturing processes, but also, and especially, is due to the great alfalfa-growing industry.

The main milk-producing feed in Merced County is alfalfa, and five to ten tons per acre during the season is a common yield. As alfalfa hay is worth a great deal more than nearly all the other kinds of hay, and, pound for pound, is worth nearly as much as wheat bran, it at once becomes apparent that alfalfa belongs to what is termed concentrated feed, and in conjunction with corn, especially as silage, makes an ideal ration and is very inexpensive.

A tract of land consisting of two sections, already seeded to alfalfa, is being subdivided into parcels of twenty to forty acres, to be sold at the remarkably low price of $65 per acre. One acre and a half will produce ten tons of alfalfa hay, support one cow, whose milk will sell for $40 at the creamery, one calf worth $10, and two pigs worth $20. If this can be beaten in California we have not heard of it. Land that can be bought for $100 per acre raised more than that many dollars' worth of sweet potatoes last year.

PRODUCTS OF THE SOIL.

Merced County is the natural sweet potato belt of the State. Crops of from 15,000 to 30,000 pounds per acre are raised annually. In the vicinity of Atwater, six miles northwest of Merced, are several thousand acres of land that seems to be peculiarly adapted to the growth of sweet potatoes, as experience has demonstrated. From the village of Atwater alone, from 500 to 800 carloads of "Merced Sweets" are shipped to market each year.

Cereals of most kinds are raised, and the county, even with its other great resources, is one of the leading wheat, barley, and corn producers, its yield of wheat in 1901 being over 13,000 tons, barley close to 2,000 tons, and corn over 700 tons.

Alfalfa grows prolifically, and produces four crops a year, besides pasturage. Table, raisin, and wine grapes find a natural home here. Orange, lemon, olive, and fig trees thrive well, while apples, cherries, peaches, apricots, prunes, pears, nectarines, quinces, and persimmons are very profitable. The smaller fruits, such as strawberries, blackberries, raspberries, currants, and gooseberries, yield abundantly. Walnuts, chestnuts, pecans, almonds, and peanuts are also easily raised. The variety and abundance of fruits and nuts produced in Merced County testify to the remarkable fertility of its soils.

A commercial product is buhach, from which the celebrated insect powder is manufactured and sent all over the United States. Over 300 acres are devoted to the pyrethrum plant, as it is called.

LIVESTOCK-RAISING.

The Los Banos Farm, the property of Miller & Lux, containing a strip of land thirty-five miles long and sixteen miles wide, raises thousands of cattle and hogs, which are fattened and marketed every year.

The Chowchilla Ranch and Pastoral Company, located near the city of Merced, is extensively engaged in the raising of pure-bred and grade shorthorn cattle, and its exhibit at the International Livestock Exhibition at Chicago, December 1, 1901, took the first prize.

The herd of thoroughbred Durham cattle on the Howard ranch is second to none in the State.

There are also large flocks of pure-bred and high-grade Merino sheep in the county.

The raising and fattening of hogs for market has proved very profitable.

Poultry-raising is a paying industry in this county. Climatic conditions the year round are favorable to the raising of chickens, yet the demand in California is greater than the supply, and immense quantities of the products of the poultry yard are shipped in from the East every year. This industry offers an assured and profitable income when made a specialty and close attention and up-to-date methods are applied.

PRINCIPAL TOWNS.

Merced is the county seat. It has fine educational facilities and modern systems of sewers and water-supply, and is lighted by electricity. It is the starting point, via the Coulterville route, to the world-famed Yosemite Valley.

Merced Falls, Snelling, LeGrand, Dos Palos, Volta, Los Banos, Atwater, and Cottonwood are thriving towns, located in districts with surroundings of unexceptional fertility.

Merced County has a population of close to 10,000, according to the last United States census, and is traversed by two transcontinental railroads, viz.: the Southern Pacific and the Santa Fé.

STATISTICS.

The report of the County Assessor of Merced County shows the following property in the county at the time the last assessment was made:

Value of real estate	$9,442,762
Value of improvements	$1,134,269
Value of personal property	$1,527,826
Value of irrigation canals	$179,437
Number of stock and beef cattle	25,344
Number of horses and mules	12,282
Number of pounds wheat	26,743,000
Number of pounds barley	3,473,400
Number of pounds corn	1,402,000
Number of tons hay	1,445
Number of hogs	7,409
Number of sheep and goats	72,062
Number of dozen chickens	3,648
Value of wagons and other vehicles	54,005
Number of acres sown to wheat, 1901	165,350
Number of acres sown to barley, 1901	53,177
Number of acres sown to rye, 1901	27,260
Number of acres planted to corn, 1901	1,800

Number of Fruit Trees Growing.

Apples	3,470	Pears	8,500
Apricots	10,527	Prunes	25,000
Figs	10,718	Lemons	1,500
Olives	26,019	Oranges	7,360
Peaches	70,600	Almonds	11,200

LAND VALUES.

Land under irrigation, that will raise almost anything, sells for from $20 to $70 per acre; grain land not under irrigation at from $10 to $20 per acre; while grazing lands are held at from $5 to $10 per acre.

The settlement of land by colonization has resulted very successfully in this county. No more successful colonies can be cited than Dos Palos colony, the Rotterdam colony, the Pioneer colony, El Capitan colony, and the British colony, all regularly laid out in tracts of five, ten, and twenty acres. Intensified farming is practiced and comfortable homes and thrifty farms are the result.

The report of the United States General Land Office, July 1, 1901, gives the acreage of vacant land open to settlement, as over 75,000 acres, and describes it as rolling foothill, mountainous, farming, and grazing.

MODOC COUNTY.

Modoc County lies in the extreme northeastern corner of California, and is bounded on the east by Washoe County, Nevada, on the north by Lake and Klamath counties of Oregon, on the west by Siskiyou County, California, from which it was created in 1874, and on the south by Lassen and Shasta counties of California. It has an area of land and water amounting to about 4,296 square miles, or 2,749,440 acres.

The county is a succession of mountain ranges and valleys branching off from the Sierra Nevada Mountains, the principal spur of which is known as the Warner range. It is principally drained by Pitt River, which flows into the Sacramento near Redding and ultimately reaches the waters of San Francisco Bay at Benicia. The Pitt River derived its name from a band of Indians inhabiting this portion of the State in its earlier days. The name of the county is taken from that of the Indian tribe which formerly inhabited the extreme northwestern part of the county, in what is known as the lava-bed section. This lava-bed section occupies over one half the total area of the county. The county has two large lakes, but barring the lakes and the magnificent cattle properties of Jesse D. Carr and W. B. Whittemore it is a sparsely settled country, fit only for the grazing of cattle. It reaches from Siskiyou County on the west to the shores of Goose Lake on the east, and from the Oregon line on the north to the center of the county on the south.

The valleys of Modoc County are its principal features, the leading ones being Surprise Valley, lying on the eastern side of the Warner range and running from Oregon on the north into Nevada at the eastern and southern ends; Goose Lake Valley, stretching from the west side of the Warner range to Goose Lake on the west and into Oregon on the north; Hot Spring Valley, comprising the central parts of the county; Jess Valley, in the Warner range; Big Valley, in the southwestern part and running into Lassen County on the south; and Little Hot Spring Valley, in the extreme southwestern corner and touching Lassen, Shasta, and Siskiyou counties.

The soil of Surprise Valley is a rich, dark loam. The part of the valley located in California is generally under cultivation, with land selling at from $10 to $60 an acre. Wheat, barley, grain, fruit, vegetables, and hay are the leading staples. Thousands and thousands of acres are in alfalfa, and the stock and dairying industries are thriving. Every ranch has a fine orchard, and ranch houses and barns, costing $5,000 or $6,000 in total improvements, are not uncommon. Trees, both shade and ornamental, abound around every place. The principal towns of this valley are Fort Bidwell (an old Indian fort, now abandoned as such, but the seat at present of an Indian school) at the northern end; Lake City, 15 miles to the south; Cedarville, at the center of the valley, and the largest and most prosperous town in the county; and Eagleville, 16 miles south of Cedarville.

Goose Lake Valley resembles Surprise Valley in all material particulars, but is not quite so large. It also is well improved.

Big Valley is varied in character of soil. As the larger part thereof is in Lassen County, extended mention is not necessary, more than to say that its principal town, Adin, is within Modoc County and supports quite a population.

The climate of Modoc County is that of the temperate zone, and the products are those of the great intermountain region which stretches from the Sierra to the western plains of Kansas. Snow falls in the valleys and much deeper still in the mountains, forming the principal supply of moisture for the development of the country. Stock is usually fed for several months through the winter, although it is not always necessary so to do. The thermometer will sometimes run below zero for a few days in the winter, but it is not for very long, and 90° is extreme heat for the summer. Even in summer the evenings are cool and delightful.

The county is well watered. Surprise Valley has nearly twenty streams, which run both winter and summer. Goose Lake Valley is equally fortunate; while the Pitt River supplies water for many farms and ranches. Many springs exist, especially in the mountains; and in Surprise Valley there are many artesian wells.

The timber of the county is pine and fir in the Warner range, and sugar pine in the western part. In the southwestern part T. B. Walker, of Minnesota, has acquired about 60,000 acres of choice sugar pine, and will extend the McCloud River Railroad therein within the next two or three years.

Horticulture has had but a small place in the industries of the county, only sufficient fruit for home uses being raised. However, the gradual approach of the railroad running north from Reno, Nevada, will increase the productivity in this line immensely within the next few years, as the county is well adapted for apples, pears, and berries. The wild plum is about the only native fruit, the cultivated fruits being brought in the earlier days from the Eastern States by the emigrants who came across the plains. A great deal of orchard planting has been done within the last three years, and the entire county is being developed at a rapid rate.

The last three years has seen a great deal of reservoir work undertaken throughout the county and its tributary valleys, and the future is bright indeed. The rains, which oftentimes come too late for the Sacramento valleys, come in time to furnish us with abundant harvests year after year.

The nearest railroad point to Alturas, the county seat of Modoc County, is Madeline, in Lassen County, and 33 miles south of Alturas. Daily trains are run from Madeline to Reno, the metropolis of Nevada.

There are seven flouring-mills in Modoc County, located at Bidwell, Lake City, Cedarville, New Pine Creek, Alturas, and Adin.

There are nine sawmills, located at Bidwell, Cedarville, Eagleville, Willow Ranch, Davis Creek, Jess Valley, Alturas, Adin, and Widow Valley.

There are four Masonic lodges, at Bidwell, Cedarville, Alturas, and Adin; one Royal Arch Masons, at Adin; three Eastern Star lodges, at Alturas, Adin, and Eagleville; four lodges of Odd Fellows, at Alturas, Bidwell, Adin, and Cedarville; and the A. O. U. W. and Knights of Pythias also have lodges.

The population of the county by the last census is about 5,100, over 2,100 being in Surprise Valley and about 1,300 around Alturas and in the Hot Spring valley country; the rest being in Goose Lake and Adin, with scattering settlements elsewhere.

There are quite a number of school districts. The finest school house is at Cedarville; it is a two-story, four-roomed building, in the center of a town square, and is surrounded by trees. There are nine school districts in Surprise Valley, five in Goose Lake Valley, eight around Alturas, one in Jess Valley, and eight at the west end of the county.

Modoc County has had its greatest development within the last four years, and while it has derived considerable notoriety by reason of the lynching of three Indians, one Mexican, and one squaw man by local settlers in the extreme southwestern corner less than 2 miles from Lassen, 10 miles from Shasta, and 15 miles from Siskiyou, still it has within itself more than abundant capital to develop its resources, and is so far independent of outside money and outside people that it makes no attempt whatever to encourage either investment or immigration, being content to wait for natural increase to settle the vacant lands and for home money to improve and maintain the country.

The country naturally drains its trade toward Reno, in Nevada, where connection is made with the Southern Pacific Railroad. The interests of Modoc County are those of Nevada, of which Surprise Valley was originally a part, and the majority of the people, in the eastern part of the county at least, favor annexation to the mother State, Nevada.

MONO COUNTY.

Mono County is a long, narrow county, its greatest length bordering on the State of Nevada, which forms its northeastern boundary. On the south it is bounded by Inyo, on the west by Fresno, Mariposa, and Tuolumne, and on the northwest by Alpine County. It has an area of 2,796 square miles, or 1,889,440 acres, of which all but 400 square miles are mountains.

The western portion of the county lies among the Sierra Nevada Mountains, the heights being clad in snow, and the slopes of the range being covered with forest trees. Among the highest peaks in the county are Mount Dana, 13,627 feet; Mount Lyell, 13,217 feet, and Castle Peak, 13,000 feet. The eastern portion of the county, which is usually spoken of as a strange, mysterious country, is of a desert-like, volcanic character, abounding in salt pools, alkali, and volcanic table-lands, the characteristics of this portion of the county being significantly indicated by some of the local names, such as Hot Springs, Geysers, Sulphur Springs, Black Lake, Soda Pond, Volcanoes, Obsidian Mountain, Deep Cañon, Volcanic Table-Land, Red Crater, Adobe Meadow, and Oasis. Mono Lake, situated in the center of the county, is about 15 miles long by 10 miles wide, its waters being a somewhat unusual compound, various chemical substances being found in solution in them. This lake has the appearance of having once been the scene of volcanic action; the country surrounding it, as Bodie, Aurora, and Benton, abounding in minerals. A number of volcanic cones, having extinct craters, lie to the south of the lake, and a great portion of the formation of the district may be considered volcanic; débris consisting of porphyry, granite, limestone, and a remarkably pure obsidian, and deposits of lava are found at Aurora and Table Mountain. The fires of the ancient volcanoes may not yet be all extinct, for upon the islands in the center of the lake jets of hot vapor escape, and there are a number of boiling springs of water. The great bluffs and rocky ravines of the Sierra come almost to the western shore of the lake, while upon the western side salt deposits and lines of driftwood mark the plain, showing very distinctly what were the former more extensive shores of this sheet of water. Upon the bluffs of the western side are water marks, which make it seem highly probable that the waters were once almost a thousand feet above their present elevation, spreading out over the plains to the east to form a great inland sea. The lake receives a number of small streams, but is without a perceptible outlet. Owens River in the south, which takes its rise in a high peak in the Sierra, Mount Kitten, and Walker River in the north, are the principal streams in the county, the one passing through the southern part of the county into Inyo, the other continuing its course, after rising in Mono, to the State of Nevada.

Mono County, being situated on the eastern slope of the Sierra, and the larger portion of it in the high mountain regions, has a climate totally different from that of the western slope, and resembles more that of the Eastern States than that of California. In the higher altitudes the summer days are pleasant, although in the lower valleys the mercury will rise well toward 100° occasionally. The winters are characterized by heavy snowfalls and severe frosts.

The valley soil of Mono is formed by erosion from the mountains, and is to a great extent sedimentary, with alluvium. A great deal is barren and sandy, and great tracts of alkali are found. There is, however, a considerable amount of fertile land, which, by the aid of irrigation, can be made productive, and already much has been brought under cultivation by this means. Cereals do not attain that perfection of growth so desirable, partly from the extreme altitude of the county, and partly from the rigors of the climate, attendant to some extent thereupon.

Mono County has, however, a considerable cultivable area; much of it is very rich and fertile. This lies mostly in the western part of the county. Among the richest of her agricultural lands may be classed Bridgeport Valley, or Bridgeport Meadows, as it is frequently called; Antelope Valley, Long Valley, and the famous Adobe Meadows in the vicinity of Mono Lake. There is also a large amount of rolling foothill country admirably adapted to grazing.

The agricultural resources of the county are chiefly confined to the raising of hardy cereals and vegetables for home consumption, and the small surplus finds a ready sale in the adjacent mining camps.

Apples are of a superior quality and flavor and thrive well. Plums and peaches are grown on a limited scale. Berries also do well, considering the altitude.

Grazing is the leading industry and the pasturage is good and plentiful. Considerable dairy cattle are moved from the valleys during the summer months, and an excellent product of butter is made. Large bands of sheep are also driven to its mountains for summer pasturage. Goats, hogs, horses, and mules are raised in considerable numbers.

Farming is increasing and much new land is constantly being brought under cultivation. Water in many of the valleys is plentiful, and irrigation will always secure a crop in all the valleys, which are very fertile.

The winters are quite severe and long, it being necessary to provide shelter for stock. Considerable hay, both natural timothy and alfalfa, is raised for winter feeding.

The timber belt of Mono is very large and of good marketable character; but as there are no means of transportation to markets the development of the lumber industry is retarded, although considerable quantities are used for local mining purposes.

Bridgeport is the county seat, and is located in a prosperous farming section of the county.

Considerable mining for the precious metals is carried on, the leading mining camp being Bodie, from which place over $30,000,000 in bullion has been shipped in the past. This industry is again prosperous; the introduction of the cyanide process permitting the profitable working of large bodies of low-grade ore that heretofore were of no value, on account of the cost of reduction.

Lundy, Aurora, Sweetwater, Benton, and Castle Peak are all historic camps of the early days of silver mining. They are now receiving new life and capital is being attracted and new developments have been made. Altogether the interests of the county are more prosperous than for years.

The latest report of the United States General Land Office gives the area of vacant lands in the county as over 1,500,000 acres, describing the same as grazing, agricultural, timber, and mineral. The county is very sparsely settled, but offers considerable opportunities for capital and settlers.

MONTEREY COUNTY.

Monterey County is situated about 100 miles south of San Francisco, and 500 miles north of Los Angeles, on the Pacific coast; it is bounded on the north by Santa Cruz County and Monterey Bay, on the east by the counties of Kings and San Benito, on the south by San Luis Obispo County, and on the west by the Pacific Ocean. It is 124 miles long and 45 miles wide, its extreme length being from north to south, and covers an area of 5,580 square miles, or 3,571,200 acres.

Owing to the peculiar topography of the county, with its rough mountains and broad plains, its great river running from south to north with tributaries from either side, its rolling hills and rugged mountains, it is found to be a miniature of the State with its entire diversity of climate and soil, enabling it to produce everything produced in the State, and rendering it one of the most desirable regions in the State for settlement.

Its rivers furnish a never-failing supply of water for irrigation, and the mountains abound in all the minerals—gold, silver, copper, coal, bitumen, and oil—which will be referred to separately in another place.

The county is divided into three sections—the mountains and hills on the east, mountains and hills on the west, and the great Salinas Valley situated between these ranges of mountains, and opening upon Monterey Bay on the north. This valley extends south from Monterey Bay over 100 miles, and is from 5 to 15 miles wide.

THE EASTERN SECTION.

The Gabilan range of mountains extends down the eastern side of the county. Gabilan Peak, near the northern end of the chain, is 3,381 feet above the level of the sea, and Mount Cholame, 45 miles to the southwest, is 3,800 feet in height. This range extends from the Pajaro River on the north—where the county begins—through the entire length of the county in a southeasterly direction.

Going south from Pajaro River, the first twenty miles of the range consists of low hills and small valleys, covered with grass and timber. In this belt, Carneros, Aromas, and Prunedale districts are notable for their beautiful homes and extensive orchards of apples that go largely to supply the shipments from Pajaro. Here are also found extensive apiaries. All fruits, vegetables, and berries grow to the highest state of perfection.

The next forty miles of the range is composed of higher and rougher mountains, which produce an abundance of grass, and are used for grazing stock cattle on a large scale—the more accessible parts for dairying.

Southeast of this portion, from the San Lorenzo River to the southern boundary of the county, the mountains are low, rolling hills, interspersed with numerous little valleys, among which are Peach Tree, Cholame, Slack's, Long, Indian, Priest, Parkfield, and several others, all possessing rich soil and delightful climate, fine grain and stock ranches, small orchards and beautiful homes. All have fine schools, and many have nice churches with regular services. The town of Parkfield has three stores, two hotels, blacksmith shop, school-house, church, postoffice, etc., and is in the upper Cholame Valley, near coal and oil fields.

THE WESTERN SECTION.

The Santa Lucia Mountains, on the west side of the county, extend from Monterey Bay in an unbroken line southeast, bordering the coast, as far as San Luis Obispo County. After leaving the bay, for 20 miles they are a rough mass, with an average width of 18 miles, and an elevation of 5,000 feet at the highest point.

The Carmel River rises in this range, runs north, and empties into Carmel Bay about 5 miles south of Monterey. It is a beautiful stream, draining the hill country north and east of the northern termination of the Santa Lucia Mountains, and abounds in mountain trout. The valley bordering the river is one of the richest in the State, producing beets, potatoes, berries, vegetables, and fruits, and having three or four of the finest apple orchards in the county. The hills are covered with grass, feeding fine cattle for dairying purposes.

Carmel Bay is 4 miles in length, 2 miles in width, and has deep water. In the mountains near its border are deposits of coal.

San José Creek rises in the same mountains, runs north and empties into this bay. The Big and Little Sur rivers also rise in this range, flow west and empty into the Pacific Ocean. All these streams are noted for trout-fishing, and their little valleys contain fine farms and stock ranches. Idlewild, on the Sur, is a pleasant summer resort for camping parties.

Farther south the mountains are heavily timbered with oak, redwood, and pine, and are used for ranging cattle.

Point Lobos juts out into the ocean at the southern extremity of Carmel Bay. Point Sur is about 20 miles farther south, near the mouth of the Sur River. Cypress Point is situated at the northern point of Carmel Bay, and is one of the grandest spots on the coast. The dark cypress trees—from which the point was named—cover the headland and skirt the water's edge, and their seeds have been planted all over the State.

About 90 miles south of this point is situated Los Burros district, consisting of several paying quartz and placer mines, gold mining being the principal employment.

Salinas River has its source in San Luis Obispo County, enters Monterey County nearly in the center of its southern border a few miles north of the mission of San Miguel, runs north about 100 miles, and empties into Monterey Bay. It is the third river in length in the State, and its tributaries are the Estrella and San Lorenzo from the east, Arroyo Seco, San Antonio, and Nacimiento from the west. The Arroyo Seco empties into the Salinas about 30 miles southeast of Salinas City. About 20 miles up the stream the valley narrows into a cañon, leading back into the mountains in a southerly direction, and heading far up in the Santa Lucia range. The little valleys are rich, and all cultivated to grain; the mountains are used for grazing. In this cañon are fine indications of oil, the wells sunk showing flattering prospects.

The San Antonio and Nacimiento rivers flow through the upper part of their course in a direction opposite to that of the Salinas, being a southeasterly direction. For more than 30 miles they are nearly parallel, and only 5 or 6 miles apart. The region between consists of high ridges composed of bituminous slates, underlaid by sandstone, in which there are the finest prospects for oil in the State; the bitumen also being of superior quality.

Where the San Antonio River emerges from the mountain gorge and opens out into the beautiful Jolon Valley, is to be found the San Antonio Mission, still in a fair state of preservation, built by the Mission Fathers. It is one of the most picturesque valleys in the State, with its great, towering oaks, and rich, alluvial soil. This is the finest wheat belt in the county, and deciduous fruit trees produce well. The olives can not be excelled in the State, and at the old Mission still stand trees now two hundred years old. The valley is about 15 miles long, and 3 or 4 miles wide. In the vicinity of Pleyto are some fine orchards.

Along the Nacimiento River, south to the border of San Luis Obispo County, are low mountains used for farming and stock-raising, many farms containing fine orchards of deciduous and semi-tropical fruits. There are numerous small valleys, like Sapaque and Hames, which are rich and productive.

On the east, the Estrella is a wheat-growing district, with cattle and sheep in the hills.

Near the head of the San Lorenzo are great coal deposits which are being worked, and coal shipped to San Francisco. Lower down, the bitumen is of fine quality, and two mines are operated.

The portion of Pajaro Valley lying south of the Pajaro River, and running to Monterey Bay on the southwest, is in Monterey County, and is about 15 miles long, and from 6 to 8 miles wide. The land is exceedingly fertile and under a thorough system of cultivation, producing immense crops of all kinds of vegetables, grain, fruit, and berries. Well-tilled farms greet the eye, and villages, school-houses, churches, and picturesque residences dot the landscape in every direction. The foothills are covered with sleek flocks and herds, and the lower ranges are timbered with live oak. The Pajaro River flows southwesterly and finds an outlet in Monterey Bay, near the mouth of the Salinas River.

THE SALINAS VALLEY.

The great Salinas Valley, embraced by the Gabilan Mountains on the northeast and the Santa Lucia range on the southwest, opens out on Monterey Bay and extends southward 100 miles, with an average width of 10 miles, therefore its area is about 1,000 square miles, or 640,000 acres. It begins to form near San Luis Obispo County, and gradually opens until at Salinas City it is from 12 to 15 miles wide, and is as fine a section for farming as can be found in California. Salinas River flows through its entire length. The land may be divided into three classes, viz.: First, the heavy, rich bottom lands, which produce almost everything, the soil being sediment and black adobe, which often contains just enough sand to make it work easily. Second, the mesa or table lands, particularly adapted to growing wheat, barley, and other cereals;

the average yield of wheat being 30 bushels, and of barley, 50 bushels per acre. Third, the uplands and slightly rolling hills, some of which are the finest fruit lands in California, and will produce oranges, lemons, grapes, peaches, apricots, almonds, walnuts, figs, apples, plums, pears, berries, and all other fruits common to the State.

CULTURAL PRODUCTS.

Nearly all semi-tropical fruits do well in some part of this county, especially in the thermal belt along each side of Salinas Valley. A number of orange and lemon trees in yards of Salinas City hang full of fruit each year and are never injured by frost. Around Salinas, apples, pears, quinces, plums, cherries, and walnuts excel, while all the fruits do well in the valley.

In barley (producing 50 to 100 bushels per acre), potatoes (the famous "Salinas Burbanks"), beets, and carrots, this valley can not be surpassed; 20,000 acres being in beets alone, and 2,000 in potatoes.

Going south, wheat excels; and grapes, peaches, prunes, apricots, cherries, and almonds grow to perfection in the foothills, cañons, and small valleys, and figs do well in sheltered places.

Olive trees flourish with all the vigor they possess in their native country. Currants, gooseberries, blackberries, Loganberries, and raspberries grow luxuriantly. Strawberries are in the market all the year round, and are shipped from Pajaro by carloads. Grapes grow to perfection everywhere in the county, except in the heavy bottom-lands of the lower Salinas Valley. Thousands of fruit trees and vines have been planted in the last few years, and many are now bearing.

Experience gained in the varied climate of the county has brought about a policy of growing the varieties of fruit that long experience and careful trials have demonstrated to be best adapted to any particular locality. Over a large area of the county the apple has been selected as the leading fruit. The English walnut, while an infant industry, has been proven to be equal in quality to any in the State. Apricots on the mesa or table lands of the Salinas Valley can not be excelled, and the Moorpark is a steady bearer. Almonds and prunes are equally prolific in the same locality, peaches in the southern part of the county, while the lower Salinas and Pajaro valleys are particularly adapted to potatoes, beets, apples, and berries.

IRRIGATION.

Extensive work has been done in the last few years in bringing the valley under a thorough system of irrigation. Near San Lucas there is some irrigation; a canal near King City, taken from Salinas River, distributes water to several thousand acres. Another, from Arroyo Seco, covers several thousand acres, and is 12 miles long. Opposite Soledad, on the south side of Salinas River, considerable irrigation is done around Fort Romie on lands purchased by the Salvation Army, and sold on most favorable terms to worthy poor in need of homes. This is one of the most prosperous colonies in America, and shows the spirit of enterprise among its promoters. At Soledad is another canal, leading to Gonzales, which covers several thousand acres of fine land.

Around Spreckels's sugar factory, 3 miles from Salinas City, a great deal of land has been irrigated for raising beets. This is the largest beet-sugar factory in the world, with an output of over 60,000 tons during the season of five months, slicing 3,000 tons of beets daily, and employs, during the manufacturing season, 700 men in the factory alone, to say nothing of the hundreds employed on the outside, hauling, topping, etc. It requires 30,000 acres of land, planted to beets each year, to supply this factory.

The main transcontinental line of the Southern Pacific Railroad enters this county through Pajaro Valley on the north, runs southeast through the entire length of the county, paralleling Pajaro and Salinas rivers, with its numerous trains daily, giving it railroad facilities for shipping and traveling unsurpassed by any county in the State, and surrounded by every comfort and luxury known to railroad science.

CITIES AND TOWNS.

Pajaro, the first town of any importance after entering the county—named for the valley—is the great shipping point for apples, berries, all fruits, and dairy products of this section, and is at the junction of the road leading to Santa Cruz, 20 miles distant. Then comes Castroville, one of the oldest towns in California, situated at the mouth of Salinas Valley, at the junction of the road to Del Monte Hotel, Monterey (the first capital of the State), and Pacific Grove.

Hotel Del Monte, "the queen of American watering-places," including the main structure and two annexes, together with the connecting wings, is simply immense, and everything connected with the establishment is on the same magnificent scale. The magnificence of the hotel is repeated in the grounds, which cover 140 acres of land laid out in lawns, flower-beds, parks, and groves, and the landscape gardening is a marvel of beauty. In this inclosure is the railroad depot, for it is a town in itself.

A little farther on is Monterey, situated on the beach of Monterey Bay, lying back on her sloping hills, overlooking the placid waters of the bay—one of the grandest and most beautiful townsites nature ever formed.

Two miles farther on is Pacific Grove, the terminus of this road; and if beauty and grandeur of scenery, delightful climate, a blue sky, and soft breezes make an earthly paradise, then is Pacific Grove fairly entitled to that name. Nestled among the pines is the little town of 2,000 inhabitants, with beautiful streets, magnificent cottages, fine churches and school-houses, charming drives, and with never a saloon in its sacred limits.

The harbor of Monterey Bay is unequaled on the Pacific Ocean. The largest battleships of our navy find anchorage within 100 feet of the shore, and during heavy storms at sea it is not unusual to see many ships of different nations anchored in the calm waters of the bay. The fishing is incomparable for quantity and variety, and a cannery is located at Monterey. There is an abalone canning factory located at Point Lobos, and one at Point Sur, both of which are run exclusively by white labor. Monterey Bay contains about one hundred and fifty species of food fish, and many are annually taken for market. There is a whaling company at Monterey, and some seasons many whales are captured.

The climate of Hotel Del Monte, Monterey, and Pacific Grove, all things being considered, is the finest in this State, having the equable mildness of Southern California without being languorous. The number of sunny days is as great as anywhere in California, while the practical absence of frost, owing to the distinctively ocean climate, makes the variation of temperature between night and day very slight. A street-car line connects the three towns, and is liberally patronized.

Returning to Castroville on the main line, and traveling 10 miles south, one comes to Salinas City, the county seat, with 4,000 inhabitants, in the very heart of the best portion of Salinas Valley, the head of the first division of the railroad, near the great Spreckels sugar factory, and containing extensive gas and water works, a large flouring-mill turning out 600 barrels of flour daily, a large creamery, a planing mill, and shops, fine stores, three banks, many churches, and four school-houses, with about 700 pupils and 17 teachers. The schools are in session ten months annually, and the high school is on the accredited list. There are many magnificent residences and well-improved streets. Fraternal societies are well represented, there being a list of 32. Newspapers are plentiful—two dailies, three weeklies, and a monthly, comprising the list. It is a good place to invest money, where one can attend church, send children to good schools, and have the best of society in a salubrious climate unsurpassed for health and comfort.

Traveling south from Salinas, the first town on the railroad is Chualar, 13 miles distant, in a fine wheat belt, having about 500 inhabitants, and containing a fine school and churches.

Ten miles farther on is Gonzales, a beautiful town of 1,000 inhabitants, with fine stores. It is quite a shipping point for grain, fruit, and dairy products, and is surrounded by a fine grain district and some alfalfa fields in the irrigated district. The Fairview fruit district is on the west, and some of the finest dairies in the county are also located here. The town has fine schools and churches.

Soledad, 10 miles farther south, named for Soledad Mission, is in another wheat belt, and is an important shipping point for grain and dairy products. It is the nearest point to Paraiso Springs, whose waters contain medicinal properties of a high order. This place is highly improved, and is called the Carlsbad of America. Soledad has a good public school of two departments, and a church.

King City, 20 miles farther south, is growing rapidly, being in a finely irrigated district. It is a shipping place of considerable importance, and has large stores, fine schools, and churches.

San Lucas, 8 miles farther south, is situated in a fine wheat belt, is the shipping point for the most of Jolon Valley, has large warehouses, and is a promising town of 400 inhabitants.

San Ardo and Bradley are located successively 10 miles apart, still farther south, surrounded by wheat fields, and from which considerable stock is shipped to San Francisco. Bradley is the shipping point for coal from the mines in Slack's Cañon.

The narrow-gauge railroad from Pajaro to Salinas parallels the main line on the west, taps Monterey Bay at Moss Landing—where there are extensive warehouses and lumber yards, and where the coast vessels stop regularly for grain and merchandise—then continues to Spreckels' sugar factory, and is used principally for hauling beets to the factory and lime rock from the quarries, though considerable grain is also shipped by it from the region west of Salinas. This road will be continued for 50 miles farther south in the near future.

TEMPERATURE RECORDS.

The climate of Salinas is one of the most equable in the world, as will be seen from the following record for the past five years, showing the highest, lowest, and mean temperature for every month in each year:

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1896—Highest	70.0	72.5	81.5	70.0	70.0	78.0	72.0	70.0	78.0	91.5	78.0	66.5
Lowest	28.5	29.0	33.0	40.0	44.0	50.0	43.0	53.0	47.0	42.0	28.0	32.0
Mean	56.9	43.8	52.1	51.8	54.3	58.5	56.9	56.9	58.1	58.5	51.9	46.0
1897—Highest	63.0	74.5	70.0	79.0	74.0	75.0	84.5	76.5	93.5	82.5	77.0	67.0
Lowest	44.8	35.0	30.0	41.5	51.0	51.0	54.0	52.0	47.0	40.0	31.0	37.5
Mean	64.0	50.3	50.0	54.2	57.0	62.0	61.4	59.5	59.6	55.7	55.6	51.6
1898—Highest	64.0	73.0	77.0	76.0	87.0	75.0	77.5	75.0	88.0	94.0	78.0	65.0
Lowest	27.5	37.0	43.0	48.0	49.5	51.0	53.0	52.0	48.0	44.0	38.0	34.7
Mean	44.6	52.4	54.9	56.3	57.1	61.1	59.5	59.6	60.1	55.1	54.2	48.9
1899—Highest	78.0	81.0	86.0	88.0	75.0	86.0	81.0	85.0	89.0	95.0	73.0	71.0
Lowest	29.0	24.0	30.0	32.0	33.0	42.0	44.0	36.0	36.0	35.0	32.0	31.0
Mean	54.5	49.5	51.7	55.3	55.6	59.1	55.5	63.7	60.5	53.3	52.9	50.2
1900—Highest	68.0	73.0	67.5	74.8	77.0	71.0	76.0	78.0	88.0	69.0	80.0	77.5
Lowest	29.0	37.5	35.0	38.5	49.0	51.0	52.0	53.0	46.5	39.0	31.0	32.0
Mean	49.2	52.6	49.2	51.7	57.2	56.9	58.9	59.6	58.5	52.5	49.2	49.8

PRICES OF LAND.

The settler who can not find within the boundaries of Monterey County some place to suit his requirements must indeed be hard to please. He can secure the most fertile soil and a faultless climate on the most reasonable terms. In the southern part of the county are many cheap lands.

MONTEREY COUNTY IN BRIEF.

Can furnish its own fuel, food, wool, leather, and oil.

Has great diversity of climate and soil, affording great choice of locality.

Has fine schools and churches in reach of every home.

Has an honest, peaceful, law-abiding population.

Has great natural resources in divers branches, developed and undeveloped, awaiting capital.

Has an equable temperature, healthful climate, and absolute freedom from malaria.

Has an abundant rainfall, insuring crops and water, and an abundance of cheap fuel near at hand in wood, coal, and oil.

Has the finest potato-growing region on earth, producing 150 sacks of Salinas Burbanks per acre.

Has the largest band of thoroughbred Angora goats in the United States.

Has the largest beet-sugar factory in the world, with a capacity of 3,000 tons of beets daily, all the beets used being raised in the county; daily cost for beets during the five months' run is $12,000, and for labor and other expenses $5,000.

Has 75 dairies, with an average of 250 cows each, producing cheese and butter, with all improved machinery for manufacturing.

Has many large stock farms, and many large and profitable apiaries.

Has as fine chicken ranches as can be found in the State.

Has large coal quarries, oil wells, and bitumen beds.

Has the finest watering-place on the coast—Hotel Del Monte.

Has the finest medicinal springs in California—Paraiso and Tassajara.

NAPA COUNTY.

Napa County lies northeast from San Francisco about 40 miles, and is 70 miles southwest from Sacramento. It has an area of 789 square miles, or 504,960 acres, and is bounded on the north by Lake and Yolo counties, on the east by Yolo and Solano counties, on the south by Solano County and San Pablo Bay, and on the west by Sonoma County. Napa is one of the smallest counties in the State, but at the same time one of the most important. Its length is about 50 miles, with a varying width of from 30 to 35 miles.

TOPOGRAPHY.

Spurs of the Coast Range Mountains pass through it, most of which have a northerly trend. Between these spurs lie several rich and very productive valleys, where the soil is very rich, the climate congenial, and the scenery unsurpassed.

The western line of Napa passes along the ridge of a chain of mountains the entire length of the county. East of this chain lies the beautiful Napa Valley, extending from Mount St. Helena at its northern end to San Pablo Bay on the south, and varying in width from one to five miles. The only valley of importance intersecting the slope on the western range is Browns Valley, which lies northwest of Napa City, and is a lovely and productive little glen. White Sulphur Springs Creek, Dry Creek, and Carnero Creek flow down from these mountains, emptying into Napa River, a stream which extends the entire length of the valley and is navigable as far up as Napa City. The lower end of Napa Valley opens out fan-like to quite a wide expanse, and is low, flat tule land. Midway between the two extremes of Napa Valley and near its center from east to west is Yountville Hill. Mount St. Helena, at the head of the valley, rears its summit nearly 4,500 feet above the level of the sea. A chain of mountains extends along the entire length of the eastern side of Napa Valley, being broken by a few streams and cañons. Conn Valley is a small widening of the valley, through which the creek of the same name passes.

In the eastern range of mountains there are some high peaks, such as Bald Peak, Atlas Peak, Howell Mountain, etc., ranging in height from 2,000 to 3,000 feet. The eastern and western ranges unite at the northern end of the county, Mount St. Helena forming the point of union. Over the Howell Mountain grade, at the east of Napa Valley, lie the broad and fertile fields of Pope Valley, and over a low divide to the south of Pope is Chiles Valley; a high range of mountains on the eastern side of Pope and Chiles valleys separates them from Berryessa Valley. This valley is drained by Putah Creek. Off the road from Napa to Berryessa are the small and lovely glens of Capelle, Gordon, and Wooden valleys.

CLIMATE.

The climate of Napa will compare favorably with that of any of the interior counties. Its situation with regard to the bay and ocean is such as to yield it all the benefits to be derived from their proximity, while its interior position and mountain ranges deprive it of their discomforts. The rainfall averages so well that a shortage of crops is unknown. The influence of the ocean breeze is felt here during the summer months to an extent amply sufficient to temper the sun's heat, while the hills act as a barrier against the fogs. The foothills of Napa County are especially famed for their climatic features, and here are found some of the most noted health resorts in the State. In the thermal belt of the foothills is found a mild and equable climate the year round, and citrus and other sub-tropical fruits will grow there. In the spring the mornings are cool and bracing, the days bright and pleasant. During the summer the weather is warm, but the heat seldom becomes oppressive, the thermometer rarely registering higher than 90°. The rains of winter are interspersed with warm, sunny days. In the valleys during the winter months there are frequent frosty nights and sharp, cold mornings, but rarely sufficient frost to injure the fruit crop.

SOILS.

The soil of Napa County may be divided into five classes. The first class, termed argillaceous, is common to the mountains on the east side of the county, and is not very productive. In Berryessa and Chiles valleys there is a large percentage of this soil mixed with a rich loam, adapting these sections to grain-growing. The second class, adobe, does not exist to any great extent, and is found only in spots in Berryessa, Pope, Chiles, and Browns valleys. It is a stiff, cold, and disagreeable soil, not easily worked. The best soil is the loam, which may be found in all the valleys of the county, but principally in Napa. It is a rich alluvium, well adapted to all sorts of vegetable growth, and especially suited to fruit. Tule soil is found from Napa City southward, and along the margin of the bay. The last class is lava, a decomposed volcanic formation, and is excellent for vineyards. It is found in the vicinity of Howell Mountain.

HORTICULTURAL AND VITICULTURAL INTERESTS.

Napa's great industry is wine-making, and her viticultural interests are second to no other county in the State. Other branches of horticulture are followed, however, and with great success. The olive has been planted extensively upon hillsides which are almost useless for other fruits, and the tree thrives and promises to become a great source of wealth. The climate of Napa Valley and its surrounding sections is admirably suited to olive culture. It corresponds strikingly in its main features to that of the south of France and northern Italy, whence come the best imported pickled olives and olive oil. The olive tree needs a temperate climate, and dreads equally excessive cold or hot weather. It requires less labor and care than any other tree. It will grow to better advantage on high and stony land, comparatively useless for any other culture. There it will bear quicker and heavier than in a rich soil, its degrees of productiveness ranging from forty to a hundred gallons per tree, when the tree has reached its full development. It has been repeatedly demonstrated that in the exceptional soil and climate of California, and when one-year-old rooted cuttings are planted, it begins to bear when four years old. It enjoys an almost incredible longevity, since many modern travelers report having seen trees in Asia Minor which are over two thousand years' old. Add to the above the simplicity and cheapness of the apparatus needed for oil making and olive pickling, the easiness of handling the crop, the cheapness of transportation of the product, considering its great value under a small volume, and its immense consumption in all parts of the civilized world, and it will be easily conceived why olive culture is going to stand foremost among the industries of California.

Napa also produces deciduous fruits of all kinds, in quantity and quality equal to the best favored sections of the State. The prune especially does well, and much attention has been paid to it of late. Apples and pears do well in all parts of the county, but make the best returns in the more elevated situations on the mountain slopes. Walnuts, almonds, apricots, peaches, cherries, prunes, and all the small fruits are raised to perfection, and without the aid of irrigation. While Napa makes no claim to superiority, or even to general adaptability to the growth of citrus fruits, yet there are many locations in the county where these thrive and yield good crops. All through Napa Valley, and especially in the foothill thermal belt, may be seen little orchards containing from half a dozen to several hundred trees, all of which are in as thrifty a condition as is possible, never having been attacked by the scale, and producing large crops of fruit, from 800 to 1,500 oranges having been gathered from a single tree.

CEREAL PRODUCTS.

While wine-making and fruit-raising are its chief industries, diversified farming in this county is carried on on a large and very profitable scale. Cereals of most kinds do well. The hay crop is a very large one and of fine quality. The soil in all the valleys being very rich, corn, potatoes, hemp, and hops do well.

DAIRYING AND STOCK-RAISING.

Dairying and stock-raising are carried on very extensively in the county, there being an abundance of natural feed; alfalfa will grow without irrigation on the lower lands. There are several creameries equipped with the latest improved machinery and appliances, with skimming stations throughout the county. The milk, after passing through the separators, is used for the fattening of hogs, which are raised in large numbers.

The highest types of pure-bred and graded livestock of all kinds are found throughout the county. The Napa Stock Farm, devoted exclusively to the breeding of thoroughbred horses, has several high-class imported stallions and over sixty thoroughbred mares. Coach, draft, and standard-bred horses are raised in several portions of the county.

Poultry farms are numerous. While not as prominent as in the adjoining county of Sonoma, poultry-raising is a very important industry. Considerable quantities of live and dressed poultry, also large numbers of eggs, are shipped to San Francisco.

MINERAL RESOURCES.

Mining is limited chiefly to quicksilver, and at present it is the leading producer of this mineral in the State. There are several good prospects for silver. Oil is known to exist, and there are a few producing wells. A deposit of building-stone of a high quality is found.

Mineral springs are numerous throughout the county, and the bottling of mineral waters is quite an important industry.

PRINCIPAL TOWNS.

Napa is the county seat, and offers liberal inducements to capital desirous of starting manufactories. At present there is a glove factory, shoe factory, a woolen mill, carriage works, and several large creameries. It has railroad communication with San Francisco, also two lines of steamers running daily.

St. Helena, Calistoga, Yountville, and other prosperous town are located within the county.

The last report of the United States General Land Office gives the area of unoccupied public land as 115,000 acres, described as hilly, agricultural, and grazing.

NEVADA COUNTY.

Nevada County is bounded on the north by Sierra and Yuba counties, on the west by Yuba, on the south by Placer, and on the east by the State of Nevada. It extends from the summit of the Sierra Nevada range, on the east line of the State, westward to the Sacramento Valley, a distance of 70 miles. It is from 12 to 20 miles in width. On its western line it has an elevation of about 1,000 feet, increasing to 2,000 or 3,000 feet in the central portion, and 8,000 feet along its eastern boundary. It has an area of 1,125 square miles, or 710,000 acres. Its natural boundaries are the South Yuba and Bear rivers on the south, and the Middle Yuba River on the north. The general course of these rivers is from northeast to southwest, and through the northern and central portions the county is partly divided by the South Yuba River, which unites with the Middle Yuba, near the western boundary of the county, and forms the main river, which is a tributary of the Feather River.

The western and middle portions of the county present a pleasing variety of landscapes in wooded hills, small valleys, or rolling uplands, a large part of which is well adapted to agriculture and grazing, and to the cultivation of orchards and vineyards. Along the extreme western boundary citrus fruits grow to perfection, as do the olive and other sub-tropical fruits; through the central portion, in which are located Nevada City and Grass Valley, at an altitude of 2,500 feet, the Bartlett pear and other fruits of the temperate zone reach their best development in flavor; while at an altitude of 3,500 feet and 400 feet farther up the mountain slopes, the apple attains a superiority unequaled by similar fruit raised at lower elevations.

The variety in soil, the difference in temperature, and accessibility of transportation, are encouragements to fruit and vineyard culture that are making a valuable and profitable production, steadily growing in importance, and which will, in the near future, prove a source of considerable local wealth.

CLIMATE.

With so much variation in altitude, from 1,000 to 8,000 feet, there is of necessity a great difference in the climate of the different portions of Nevada County; and while one section enjoys all the advantages of California climate, others are exposed to the rigors of an Eastern winter. In the extreme eastern end of the county the thermometer in January and February sometimes falls 20° below zero, and something like 150,000 tons of ice is harvested, which supplies all fruit and refrigerator cars for the East, besides supplying a great quantity of ice for California consumption. At the same time that ice is harvested in this section, oranges are picked in the western end of the county. To Eastern people who are not acquainted with California climate, this seems like a fairy tale, but is nevertheless true.

At Grass Valley and Nevada City the climate is in all respects healthful and salubrious. The elevation above the lowlands of the Sacramento Valley lifts Nevada County above malarial influences, and its middle and mountain sections are inviting to those seeking health and recreation. The temperature is comparatively mild at all seasons. In the summer, when the days are hot in the foothills, in the mountains the atmosphere is tempered to agreeable moderation, while the nights, at even the lowest altitudes, are always comfortably cool. There are but a few days in the year when the thermometer marks above 85°, and in winter it is seldom that the temperature goes below the freezing point in the middle section of the county.

The summer season is dry. Occasionally showers fall in the early part of June, but during the remainder of that month, and through the months of July, August, and September rain seldom falls, and usually in October the showers are light. The remaining months of the year comprise what is known as the rainy or winter season.

In the lower foothills snow is rarely seen, and in the middle section attains but a moderate depth. It does not remain on the ground, owing to its moist and unfrozen condition. In the higher mountains snow falls to a considerable depth, covering the summit ranges, and remains late into the following summer months; and on the northern side of the higher peaks snow may be seen at all seasons of the year.

It is the variety of climate, difference of elevation in the country, and the picturesqueness of the landscapes presented that make Nevada County particularly inviting as a home, or attractive to the tourist, who always retains a pleasing recollection of a visit to this interesting and beautiful region.

The rainfall for the season is not often excessive, the average annual precipitation being about 50 inches; but there are exceptional years in which there is a variation of 8 or 10 inches above or below these figures. These figures vary, too, with the altitude, the precipitation on the higher lands and mountains being much heavier than in the valley region. The annual rainfall makes the failure of crops an impossibility, and generous harvests are almost invariable.

WATER-SUPPLY.

The abundance of rain and the melting of snow in the mountains afford an adequate supply of water for the canals and artificial reservoirs, that can be used for the purpose of either mining or irrigation, and for the latter the demand is steadily increasing for clover and grass lands and orchards.

The soil of Nevada County, in its analysis, is similar to that of Placer County, and with proper cultivation is capable of producing cereals and fruits without the aid of irrigation.

Wherever irrigation has been used, crops of every character have been raised in remarkable abundance. There is plenty of water stored in artificial reservoirs along the summit of the mountains, such as no other county equals. Originally these artificial lakes and expensive ditches were constructed to supply hydraulic mines. The length and capacity of the main ditches connected with the reservoirs, and size of lakes of the several companies, are as follows:

Name of Company.	Main Ditches, Miles.	Capacity, Inches.	Cost.
North Bloomfield	157	3,200	$708,840
Milton	80	3,000	391,500
Eureka Lake	163	5,800	723,300
South Yuba	223	7,000	2,000,000
Excelsior	160	5,000	1,000,000
	783	24,000	4,823,640

Principal Lakes.	Area, in Acres.	Capacity, Cubic Feet.	Size of Dam, in Feet.
Bowman	950	1,000,000,000	100 x 420
French	337	660,000,000	54 x 200
Weaver	100	130,000,000	68 x 100
Fordyce	790	1,800,000,000	90 x 700
Sterling	120	300,000,000	40 x 80

FRUIT CULTURE.

Nevada County holds a prominent position among the fruit-growing counties of California, and with her great variety in soil, climate, and altitudes seems well adapted to nearly all varieties of fruit. Orchards of fruit and nut-bearing trees, and vineyards of the choicest table, raisin, and wine grapes, are specialties.

It having already been shown that while California, as a whole, beats the world in this direction, these foothills equal any other part of California in the quality, and in some things, as pears and winter apples, for special adaptation and regular productiveness. Within the past few years hundreds of acres have been planted in fruit trees and vineyards, and they all thrive well. Wine made from grapes grown on Nevada's foothills has an enviable reputation.

The abundant rainfall is especially propitious for the growth of the Bartlett pear, which here reaches its perfection. This fruit finds a ready market in Eastern States, and brings good prices.

Oranges grow well here. In at least half of the circuit, in all that part below the bench upon which Grass Valley is situated, in the lands 1,000 to 1,600 feet above sea-level, the thermal belt of the foothills, the citrus fruits are at home.

Of course, any kind of fruits adapted to temperate zones flourish in Nevada County. The olive, fig, prune, and all kinds of berries are numerous.

The principal fruit sections of Nevada County are Chicago Park, Grass Valley, Nevada City, San Juan, French Corral, Rough and Ready and Anthony House. The chief fruits grown in these sections are apples, pears, peaches, plums, cherries, grapes, and nuts; but the contiguous country is fast being converted into a veritable garden by sturdy and far-sighted toilers, whose orchards and vineyards dot the hillsides in every direction.

MINERAL WEALTH—OTHER INDUSTRIES.

Besides the fruit industry, Nevada County is the banner gold-producing county in California, having the largest hydraulic mines in the world and a number of quartz mills running forty stamps. An electric railroad is now in operation between Grass Valley and Nevada City, being a broad gauge with seventy-pound rails, and the very latest style of cars. This line is supplied with power from the Bay Counties Power Company, whose plant is situated on the Middle Yuba River, which is the dividing line between Nevada and Yuba counties. This plant has a capacity of 17,000 horse-power, and also runs the street cars of Oakland, Sacramento, San José, and other places, besides furnishing power in eighteen counties of this State. The Truckee River General Electric Company, situate in the western part of the county, supplies the mines of Virginia City with power.

The second largest paper mill in the United States is on the Truckee River, and gives employment to some four hundred men, women, and children.

The mountains are thick with sugar and yellow pine, fir, spruce, and cedar. The Truckee basin yields about 50,000,000 feet of lumber yearly through the mills of Truckee. The lumber industry in and around Nevada City, Grass Valley, and Truckee is one of the leading industries. The town of Overton has one of the largest box factories and sawmills in the State, and is connected by a railroad with Truckee.

Grass Valley and Nevada City are four miles apart, with a population in the two towns of about 10,000.

Much stock is raised and fine butter made in the high altitudes of the Sierra in summer, with every advantage of clear, pure water, cool weather, and abundant nutritious grasses.

ORANGE COUNTY.

Orange County is one of the youngest counties of California, having been organized by the legislative session of 1889, from a portion of Los Angeles County, which bounds it on the north; on the east is San Bernardino and on the south San Diego County, while its entire western border, a distance of 40 miles, is skirted by the Pacific Ocean. Its area is 665 square miles, or 425,600 acres. This is divided into mountains, 65 square miles; foothills, 100 square miles; and valleys, 500 square miles.

The Santa Ana range of mountains is the line between Orange and San Bernardino counties at the northeast corner of the former county. It is also the dividing line between Orange and San Diego counties on the east. This range also sends up a line of foothills westwardly along the seashore nearly half way across the county. All of the western portion of the county is included in the Santa Ana plain, or valley. There are also several small valleys among the foothills and along the mountain streams. The Santa Ana plain is covered with rich loam, and, with the exception of some patches of alkali, is very productive. The highest point of land is what is locally known as Saddleback, or Santa Ana Peak, with an elevation of 5,675 feet.

WATER-SUPPLY.

There is an abundant water-supply in this county. The Santa Ana River enters the county near the northeast corner, and traverses the entire Santa Ana plain, flowing into Newport Bay. Besides this stream there is Santiago Creek; also Aliso, Trabuca, Mission Vieja, San Juan, and Coyote creeks, and other streams. The last-named creek forms the boundary between Orange and Los Angeles counties on the west.

The artesian belt running through Orange County furnishes a plentiful and cheap water-supply, and makes the section as nearly independent of rainfall as it is possible to be. Much artesian water has been developed; more, perhaps, in the artesian belt west of the river than in any other portion of the county. There hundreds of artesian wells have been sunk and the farmers are installing pumping plants and organizing irrigation districts.

CLIMATE.

The climate of Orange County does not differ to any great extent from the climate of Los Angeles. On the immediate coast heavy fogs are common in the early spring months, but these are not of long duration, nor do they usually extend far into the interior. As the matter of temperature and precipitation is treated of under the Los Angeles caption, no further allusion need be made to it here.

SOILS.

In the foothills of Orange County a sharp, gravelly loam of a reddish color prevails. Descending into the valleys this loam loses its color and its sharpness and becomes black, with a large admixture of adobe and frequent streaks of alkali.

Beginning about one mile west of Santa Ana is a deposit of alkali. Here is a strip about ten miles long, which will average something like a mile in width, and on the west side of the Santa Ana River patches of this mineral may be found impregnating the soil in the vicinity of Westminster and Garden Grove. West of the Santa Ana River large deposits of peat are found, the product of tule roots and other swamp vegetation. This varies in depth from a few inches to sixteen feet. This land is considered the best for agricultural purposes in the county, and is held at a high figure by its owners.

FRUIT CULTURE.

All the fruits do well in Orange County. Many varieties of oranges and several of lemons are grown in this county, taking their names generally from the party introducing them, the country from which brought, or a peculiar marking of the fruit. The Mediterranean Sweet, Washington Navel, Valencia, Kohna, and Mission, or Seedling, are the varieties generally preferred. Of lemons, the Genoa, Eureka, and Lisbon may be named.

Oranges are shipped from here from the last of December until June, the bulk in March and April.

There is an impression abroad that while Southern California is especially adapted to oranges and other semi-tropical fruits, it is not well suited to the culture of deciduous fruits, especially apples. There are some portions of Orange County where apples are grown which vie with those of the Eastern States or Oregon, in size, flavor, and appearance. The error is partially excusable, because it is only during the past few years that much fruit besides oranges and grapes has been grown here. Now, however, large orchards are annually being planted to almost every variety of fruit that is known.

The principal fruit sections of Orange County are Westminster, Garden Grove, Anaheim, Orange, Santa Ana, Fullerton, Placentia, and Tustin, and apricots, peaches, apples, oranges, lemons, figs, prunes, and walnuts do well in this county, apricots especially holding front rank, with walnuts in the second place.

The larger amount of the fruit produced in Orange County finds a market in the East, the citrus fruits and walnuts being shipped entirely out of the county. The deciduous fruits are very largely disposed of to the fruit-drying establishments and packing-houses, and by them shipped both dry and green to Eastern States.

Orange County stands as the forty-eighth county in the State, out of a total of fifty-seven, in point of area, while it ranks as fifteenth in population, and thirtieth in assessed valuation.

AGRICULTURE.

The acreage in Orange County is 30,000 to 40,000 of barley, 12,000 to 15,000 of wheat, 4,000 to 5,000 of corn, about 3,000 of oats, 5,000 of beans, and 10,000 of hay. Much of the barley is exported for brewing purposes, and some 2,000 carloads of grain are shipped out of the county in years of average yield, besides 200 to 400 carloads of hay.

The rich bottom lands yield immense crops of corn, and large portions grow the finest crops of alfalfa and natural grasses.

The mesa, or uplands, are of the finest quality, and admirably adapted to barley, oats, wheat, flax, hemp, and the vine, as well as all the ordinary northern fruits.

Every character of soil that is found in California can be duplicated in these lands, and every product grown in the semi-tropics can be successfully raised here.

VEGETABLES.

The celery industry has grown so that the present season finds about 2,400 acres in celery. Last season the total output of celery footed up 756 cars. This season (1902) the output is expected to amount to somewhere in the neighborhood of 1,100 cars.

While celery-growing is occupying much attention just at present, other sources of income are not neglected, and of these the most important are the dairy interest and the rearing of cattle and hogs for market. The exact figures are not now available, but it may be safely asserted that cattle-raising and dairying are a close second to celery-growing, and the rearing of hogs for market is not far behind either.

The shipping of vegetables, consisting of early onions, potatoes, cauliflower, cabbage, etc., is a growing and profitable industry. Last season over 100 cars were shipped to Eastern points.

The sugar-beet is raised extensively, and a factory is located at Los Alamitos, in the western portion of the county. This factory has just completed a four months' run, during which it has consumed the product of over four thousand acres of land, and has turned out millions of pounds of sugar, ready for table use. The big sugar factories at Chino and Oxnard have drawn extensively from the soil of this county, thousands of tons of beets having been shipped the past season to these places from the vicinities of Anaheim, Buena Park, Garden Grove, Westminster, and Bolsa.

MANUFACTURES.

The Buena Park condensed milk factory, located in the northern portion of the county, and now consuming 24,000 pounds of milk per day, furnishes employment to forty men and women, and pays out $14,000 each month to the farmers for their milk and to the factory employés.

The flouring-mill at Olive has had to work day and night during the greater portion of the year to keep up with its orders. Besides consuming the wheat product of the Santa Ana Valley, this mill draws heavily from San Diego, Riverside, San Bernardino, and Los Angeles counties.

The three canneries in the county turned out large packs this season, over one million cans each, and besides this many of the large fruit-growers dried their own product and shipped it in carload lots to the Eastern market.

SHIPMENTS.

From Santa Ana, Orange, and Tustin the shipments of principal products, including celery from the peat lands, have been as follows: Oranges, 825 cars; English walnuts, 85 cars; celery, 1,200 cars; lemons 50 cars; peanuts, 20 cars; wool, 40 cars; green grapes, 50 cars; raisins, 20 cars; livestock, 95 cars; beans, 80 cars; green olives, 30 cars;

canned fruit, 80 cars; dried fruits and vegetables, 65 cars; hay and grain, 230 cars.

From Fullerton, Placentia, and Anaheim the shipments during the same period have been as follows: Oranges, 715 cars; cabbages, 45 cars; lemons, 55 cars; walnuts, 120 cars; wool, 40 cars. These, together with the hay, grain, and other products sent out, will make the annual shipments from the northern portion of the county exceed 2,500 cars.

PETROLEUM.

No business in the county has developed more rapidly during the year than the oil industry. North and east of Fullerton thousands of dollars have been expended in sinking wells, several of which have turned out to be gushers. The oil product of this county now is at least 55,000 barrels per month and new wells are being sunk every week. There has been considerable prospecting for oil in other portions of the county, but so far without success.

PRINCIPAL TOWNS.

The population of Orange County is over 20,000. Santa Ana is the county seat, with a population of 5,000. Anaheim is next in size, Orange following. Other towns and villages are Bolsa, Tustin, Buena Park, Los Alamitos, Garden Grove, Westminster, Fullerton, Placentia, La Habra, McPherson, El Modena, Villa Park, Olive, Yorba, Newport, Fairview, El Toro, and San Juan Capistrano. Of the above places, Tustin is a charming suburb of Santa Ana, with splendid orchards, attractive homes and people of refinement; Fullerton, in the northern part of the county, is a place of much business and the headquarters of the oil industry of that section; El Toro is made up in large measure of English settlers of wealth and progressive ideas; Westminster, Garden Grove, Fairview, and Newport are surrounded by damp farming lands, and are the sources of supply of much of our vegetable and dairy products; while San Juan Capistrano in the extreme south is the seat of one of the largest and most interesting old missions upon the coast.

PLACER COUNTY.

Placer County lies between latitude 38° 70′ and 39° 30′. Its direction is northeast and southwest, and it is about 100 miles long and of varying widths, from 10 to 30 miles, the course and distance being defined by the course of the rivers which define its boundaries. It extends from about 8 miles from the Sacramento River to the summit of the Sierra Nevada mountains. Just above Auburn, between the Bear and American rivers, the county is very narrow, being but about 8 miles across. Above Auburn it widens out into the two divides lying between the Bear River and the Middle Fork of the American River. These are known as the Dutch Flat or Railroad Divide, and the Forest Hill Divide. The southwestern portion of the county is more regular in shape than the part just described, being bounded on the east by El Dorado County, on the south by Sacramento County, on the west by Sutter County, and on the north by Nevada County. This section contains the foothill and agricultural lands. Its shape is nearly a parallelogram, the southwest two thirds being on the plain proper and the northeast one third being the foothill and fruit district.

TOPOGRAPHY.

The area of Placer County is 1,429 square miles, or 914,560 acres. Of this, 810 square miles are mountains, 450 square miles foothills, and the remainder valleys. The entire extent of the county faces toward the west, extending from an altitude on the plains in the western portion of the county of some 40 feet to over 7,000 feet at its eastern boundary line, embracing nearly every variety of climate known in the State. At the eastern boundary of the county, separating it from the State of Nevada, is Lake Tahoe, one of the most picturesque lakes in America. The topography of Placer County is as irregular as is its shape. Imagine the whole Atlantic Coast from Labrador to Tallahassee incorporated into one county, and one will have a fair idea of what may be found in Placer, exaggerated as to size, but not as to the great variety of climate, elevations, soils, and resources.

In fact, as to resources, the whole Atlantic seaboard can hardly equal the endless variety to be found within the borders of this single county, which rivals Florida in the quality of its oranges, excels New Jersey in peaches, equals the New England States in its granite quarries, and compares favorably with Maine in the quality of its lumber.

From an elevation of about 2,500 feet up to the summit of the mountains snow falls in the winter season, light at the lower edge of the line, and increasing in depth as it ascends the Sierra. Here is a strip of territory from the snow line up to an elevation of 3,000 feet, where the snowfall is not greater than in New England, and where the winter temperature is much higher. It is particularly well adapted to the apple, the pear, and a great variety of vegetables.

CLIMATE.

At Auburn, the county seat, the average temperature for winter is 46.2°; for spring it is 56.4°; summer, 74.3°; autumn, 61.7°. The yearly mean of the maximum temperature at Auburn is 83.17°; at Colfax, 85.42°; at Rocklin, 84.33°.

The average annual rainfall at Colfax is about 46 inches, and at Auburn it is about 26 inches.

SOILS.

The soil of the western or valley portion of Placer County, around Roseville, Lincoln, and Sheridan, is of the same general alluvial composition as all the soil in the great Sacramento Valley, and is well adapted to the growth of grain. Over 30,000 acres are annually devoted to wheat, barley, oats, and hay. The low foothills back of Lincoln are excellent for the grape, and many new vineyards are springing up in that locality. They produce table and wine grapes, and raisins of superior quality.

The soil of the valley lands is mostly a red loam, mixed with considerable clay in spots; that of the foothills is a gravelly red loam, in places light and sandy, and is excellent for the production of fruits. Farther up the soil changes to a red character with a slate bedrock. This, too, is very fertile. The agricultural region includes the valley and foothill lands all the way from the western boundary of the county to an elevation above Colfax. The foothills everywhere possess a soil which only needs cultivation. The granite soils around Newcastle are composed largely of clay, sand, soda, potash, lime, phosphorus, iron, and magnesia. The constant decomposition that is going on appears to be of nearly endless duration, and of such a nature as to render the soil almost inexhaustible. Artificial fertilization is entirely unnecessary.

For an irrigation water-supply Placer has three sources—the Yuba, Bear, and American rivers. Including its branches, the Bear River irrigation ditch is 200 miles in length. This system is now the property of the South Yuba Water Company, which has increased its capacity and brings water from the Yuba River, so that abundance of water is assured. There are several other canals originally built for mining but now used for irrigation.

FRUIT CULTURE.

Placer County holds a foremost position among the fruit counties of the State, being the most easterly of the counties of California. With the Central Pacific Railroad running the entire length of her territory, she is one day nearer the Eastern market than any other part of the State, a very large item in the shipping of green fruit to market. In her thermal belt fruit ripens earlier than in most other places in the State, another large advantage to her. There is hardly any fruit in the entire range of production that will not grow in some portions of Placer. Pears, plums, prunes, apples, apricots, cherries, persimmons, pomegranates, quinces, and figs all do well. Peaches have been grown to some extent for the past twenty-five years, and in all that period a failure of a crop has been unknown. Fine oranges are produced, and Placer holds a position beside Butte in the northern citrus belt. In the production of small fruits, berries, and table grapes, Placer holds a foremost place.

The chief fruit sections of Placer and the fruits to which they are especially suited are as given below: Loomis, peaches, figs, and grapes; Penryn, peaches, pears, plums, and grapes; Newcastle, peaches, pears, plums, cherries, and grapes; Auburn, pears, grapes, and peaches; Colfax, pears and grapes.

The largest cherry trees in the world are to be seen at the ranch of Robert Hector, from one of which has been picked as high as 3,000 pounds in one season. At the Pan-American Exposition, Placer carried off the gold medal for peaches, oranges, and grapes. An exhibit of fifty oranges averaged twenty-four ounces in weight.

A lemon, now on exhibition at the Sacramento Chamber of Commerce, measures 22 inches in circumference the small way and weighs three and a half pounds.

Olive-growing is a profitable industry in Placer County. The principal orchards are provided with manufacturing plants and are producing a very fine quality of oil. The first prize for olive-oil was awarded to Placer County at the Chicago World's Fair. In addition to oil, large quantities of pickled ripe olives are shipped, the demand for which largely exceeds the supply. Land suitable for olive culture can be bought for from $15 to $50 an acre. The trees begin to bear in about four years, and they will thrive without irrigation, provided the orchard is extensively cultivated.

DIVERSIFIED FARMING.

Diversified farming is practiced very generally in Placer. Wheat, barley, oats, alfalfa, and hay are raised in considerable quantities, there being close to 60,000 acres devoted to their production.

Dairying and stock and poultry raising are also extensive industries.

Butter-making is carried on in the summer, the mountain ranges providing plenty of natural feed; the butter is of a very fine quality.

Considerable quantities of vegetables are raised, not only for local consumption, but also for shipment abroad.

TIMBER RESOURCES.

Much sugar and yellow pine, fir, spruce, and cedar are found in the mountains, and the lumber output from that section has been very large for many years. Oak and scrub pine abound all over the foothills, and fuel is plentiful. The annual output of lumber amounts to over 16,000,000 feet, principally yellow and sugar pine, the latter being of the finest grade produced in California.

MINERAL RESOURCES.

Placer County ranks well up among the mining counties of the State. Her average yearly contribution to the world's wealth at this time is something like $1,000,000, mostly gold. The total production since the discovery of gold at Auburn, May 16, 1848, is estimated at $75,000,000. The mining methods in vogue include drift, river, placer, and quartz. The latter is yet in its infancy, while Placer's drift mines are among the largest in the world.

The granite quarries in Placer County rank with the best in the United States. Nearly all the street curbing in San Francisco is from the Placer quarries, while the State Capitol at Sacramento is an example of the value and beauty of foothill granite.

Potter's clay is found in abundance at Lincoln, from which is manufactured sewer pipe, tiling, pressed brick, architectural terra cotta, and glazed brick for interior decorating. Among the notable specimens of the latter none is more prominent than that to be seen in the interior of the Mills Building, San Francisco.

Placer County is a natural sanitarium. As a resort for patients suffering from pulmonary diseases leading physicians say it has no equal on the Pacific Coast. It is here patients find relief and some of them are cured. A resumé of the cases of sickness in which material benefit is attributed to Placer's beneficent climate would read like a leaf from a patent-medicine almanac. The altitude is just right for people suffering from consumption or bronchial diseases.

The returns of the United States General Land Office in the report of July 1, 1901, give 104,287 acres of unoccupied land in the county, describing the same as mineral, timber, and grazing.

PLUMAS COUNTY.

Plumas is a mountain county, and much of what has been said in describing El Dorado, Alpine, and Placer counties is applicable to Plumas. Mountain chains define its limits on several sides, its bounding counties being, on the north Shasta and Lassen, on the east Lassen, on the south Sierra and Butte, and on the west Butte and Tehama.

This county extends for a distance of 50 miles from north to south, and 75 miles from east to west, in the heart of the Sierras, having Lassen Peak, with an elevation of 10,577 feet, on its northern border, and Pilot Peak, 7,605 feet, and Spanish Peak within its boundaries. Between the parallel ridges and spurs of the mountain range there are some picturesque and fertile valleys. The Feather River and its tributaries, with their deep cañons that have cut down in places to a depth of over 2,000 feet, afford drainage to the county into the Sacramento River. It has less plains land than the counties lying to the south; but, on the other hand, Plumas County differs from the counties lying to the south of it in contour, the surface being more of a rolling character. A great deal of rich valley land is thus placed at the disposal of the husbandman. There is virtually no limit to the fertility of the soil in those valleys, composed as it is of the alluvial deposits carried down by the melting snows and the rains of centuries from the overhanging Sierras Still, much of Plumas is up among the mountains, lying in the midst of the Sierra Nevada range. Some of its scenery is among the wildest and most picturesque in the State, snow covering the summits of the mountains, their slopes being clothed with magnificent forests of pine, fir, and oak trees, and high ridges alternating with abrupt chasms and deep cañons, through which tumble running streams. There are grassy valleys of considerable extent throughout the county, which are cultivated by agriculturists, among them being Big Meadows, Mountain Meadows, Indian, Genesee, American, Beckwith, Butte, and Meadow valleys. Big Meadows Valley, 15 miles long by 4 miles wide, is the largest of these mountain valleys, and is immediately adjacent to Mountain Meadows, of nearly the same size, and also to several smaller valleys, also cultivated, the whole constituting a plateau high up in the mountains, the elevation being 4,500 feet. Indian Valley, an important and prosperous district, is 11 miles in length by 2 miles in width; American Valley being the same size. Both connect with smaller valleys, and support several small towns, as well as the farms scattered over their extent. All these valleys are fertile, well watered and timbered, and contain an area of agricultural and grazing lands sufficient for the support of many thousands of people.

The greater part of Plumas County is located in the Sierra Nevada Mountains, and has the climate peculiar to that section. In the higher altitudes are long, cold winters, with heavy snowfall and zero weather. In the valleys the winters are much less severe, being only moderately cold. The summers are perfect. Very hot weather is unknown, even in the lower valleys. The rainfall will average about 40 inches annually.

Where irrigation is needed Plumas has abundant water therefor. Mountain rills run down every cañon and ravine, and streams take their course through every valley. Two important branches of the Feather River rise in this county. The valleys are well watered, but generally treeless. Pure mountain springs and streams abound, and are found very desirable for dairying and general farming. Many of the valley ranches are irrigated from mountain streams. Round Valley reservoir covers about 1,000 acres, and supplies water for mines and for irrigating the lands of Indian Valley.

Indian Valley is the largest grain-producing section of the county; it produces annually about 60,000 bushels of oats, wheat, barley, and rye. The oats raised in this valley average from 40 to 48 pounds per bushel, and the wheat and rye from 60 to 65 pounds. The average oat yield is about 55 bushels per acre, and of wheat the average is about 35 bushels per acre. This valley also contains a number of large dairies, averaging from 40 to 150 cows each. The butter is sold principally among the mines of Plumas and Sierra counties. The valley also produces annually about 7,000 tons of hay, which is fed to local stock and which number about 2,500 head. The average yield of hay is about three tons per acre.

American Valley produces a great quantity of grain of all kinds, and alfalfa and timothy hay; a great many cattle and horses are also raised. The average yield per acre is about the same as that of Indian Valley. Quincy, the county seat, is in this valley.

Butte Valley, Big Meadows, and Mountain Meadows are chiefly devoted to stock-raising and summer pasture. Big Meadows, which is situated at the head of the North Fork of Feather River, is a fine summer resort. The average yield of hay of the latter three valleys is over two tons per acre, of a high quality of timothy.

Many parts of Plumas County are especially adapted to deciduous fruits, apples and pears doing especially well. Plums, prunes, nectarines, and peaches also do well in many localities, and where favorable conditions exist the trees yield abundantly.

Currants, gooseberries, blackberries, raspberries, and strawberries grow in great quantities and to perfection.

The apple nowhere in the State grows nearer to perfection than in Plumas County, but fruit is only raised on a limited scale for home consumption. Railway connections would greatly increase the production, for no county produces finer flavored fruits than are raised in its mountain valleys. The lack of transportation facilities is a great drawback to the fruit as well as all agricultural industries.

Sheep and cattle are driven in annually in large numbers for summer pasturing; the mountains and their valleys affording abundant natural feed and water. The choicest article of mountain butter is produced.

Poultry and eggs are raised for home consumption and in quantities to supply the mining camps of Plumas and Sierra.

The magnificent virgin forests of sugar and yellow pine, fir, spruce, and cedar timber are of great size and value. The extension of the Boca & Loyalton Railroad into the county to tap these great timber forests is now nearly completed, and the lumbering industry is rapidly coming to the front. Plans are being made for establishing one of the largest milling and manufacturing plants in the State, and the same will, it is expected, be in operation in 1902.

Considerable mining for the precious metals is carried on, and both quartz and hydraulic mines are operated on a very large scale, and is one of the most profitable industries in Northern California.

The copper prospects of Plumas County are now attracting the attention of capitalists, and considerable prospecting work was done the past year, with a very encouraging showing, and there is no doubt that several of them will, when fully developed, prove to be large and profitable mines.

Iron, marble, asbestos, and other minerals exist in large quantities, and it only needs the influx of capital to open up the mining industries and bring Plumas County to the front as a leading and profitable mineral producer, exceeding in the near future the great yields of the precious metals that have been extracted in the past. The completion of the railroad into this county will, no doubt, be the means of interesting the requisite capital to develop the mining industry.

The last census gives the population of Plumas County as 4,657. The principal towns are Quincy, the county seat; altitude, 4,000 feet; has a bank, newspaper, and two mills. The other towns are La Porte, Prattville, Greenville, Taylorville, Beckwith, and Crescent Mills, all dependent on mining, stock-raising, lumbering, and dairying.

There are a number of summer resorts situated on the Feather River or its tributaries. Hundreds of campers pass the summer months here, the trout-fishing of Plumas being unexcelled. Big Meadows is one of the most famous resorts in the State for followers of angling. Game of all descriptions, of both fur and feather, is very plentiful, and excellent sport can be obtained in all parts of the county.

Prices of land are naturally very reasonable at present, but they will steadily advance, no doubt, on completion of the railroad. As it has been, teaming of all products and staging had to go by Chico or Oroville in Butte County to reach railroad connections, or by Mohawk and Sierra valleys to Truckee and Reno to reach the main line of the Central Pacific.

RIVERSIDE COUNTY.

Riverside County is bounded on the north by San Bernardino County, on the east by the Colorado River, on the south by San Diego County, and on the west by Orange County. It is one of the youngest counties in the State, being formed in 1893 from the southwestern part of San Bernardino and the northern part of San Diego.

The progress of the county is practically confined to its northwest corner, embracing the largest orange-growing district in the world. The rest of the county is largely undeveloped, a desert region that is believed to be a storehouse of the useful minerals and metals.

The past year has been one of exceptional progress and prosperity, and a considerable area of new land has been brought under cultivation. Many new orchards, both citrus and deciduous, have been set out. Alfalfa has also been planted on a large scale.

The orange crop in the county is the largest in the State, the output for the last season being 5,333 carloads, besides 250 carloads of lemons. The growing of citrus fruits is the main industry in the county at present, although deciduous fruits of most kinds do well, particularly apricots and prunes. The olive thrives and a very fine grade of oil is produced. Melons and cantaloupes are extensively grown and mature early.

New orchards, of both citrus and deciduous fruits of many varieties, are now coming into bearing and an increased crop of all fruits will be recorded the coming season.

Diversified farming is quite a feature in several sections of the county. Alfalfa grows very luxuriantly; broomcorn does well, and is a very prominent and profitable crop. The sugar-beet thrives, and considerable new land has been put in cultivation the last season.

Dairying is also a profitable industry, and modern creameries with the latest appliances are located in different sections of the county. The stock used for dairying purposes is of a very high grade, mostly pure-bred representatives of the milk strains.

Considerable stock and hogs are fattened for market. The poultry industry receives considerable attention.

Bee-keeping is another growing industry, and a fine grade of honey is produced.

The capacity of several of the city of Riverside's manufacturing establishments, including an iron works and wood-molding works, has been largely increased during the past year. The Riverside Machine Brick Company has installed a new dry-press plant, costing $15,000, with a capacity of 25,000 bricks a day. Claude Hancock has installed on the Indian school grounds a $10,000 soft-mud brick machine, with a capacity of turning out 40,000 bricks a day. In the early part of 1901 the city completed a $40,000 steam power plant, to generate electricity for power and lighting purposes. The sewer system has been extended and the streets extensively improved. A new public park and polo grounds on Magnolia Avenue are among the attractions that have been added to the city during the year. A branch of the electric road has been built and put in operation, extending from a junction with the main line at Main and Fourteenth streets, to Victoria bridge, a distance of nearly two miles. At the terminus of the line may be seen the splendid improvements made by the Chase Nursery Company on and surrounding Victoria Hill. During the past year, approximately 750 acres of land have been planted to oranges and lemons—200 acres in the Highgrove district, 250 acres in West Riverside, and 300 acres in Arlington Heights district. Last season 5,335 carloads of oranges and 250 carloads of lemons were shipped from Riverside.

The Riverside Water Company, chief of the companies that supply Riverside with its fine water system, embracing a continuous flow of over six thousand inches for the colony, has added to its irrigation system by boring two artesian wells, one of which is the deepest in San Bernardino County. It is 967 feet deep and has a flow of 187 inches; the other well has a flow of 100 inches. Three wells have been sunk on good pumping territory as an experiment, but have not yet been tested. The company has planted about 300 acres of new orange orchards and 100 additional acres of alfalfa. The domestic water system has been improved by the construction of a cemented storage reservoir, covered with an insect and dust-proof building. Three artesian wells sunk give an addition of forty inches of flowing water.

Highgrove, located three miles northeast of Riverside, is becoming an important fruit-shipping point. Both the Santa Fé and Southern Pacific railroads have stations here, and two large packing-houses will be in operation this season. Many new groves are coming into bearing and several hundred acres have been planted to oranges during the year. A free rural mail delivery service has been established.

In West Riverside, comprising a rich section of varied resources across the Santa Ana River from Riverside, a considerable acreage has been planted to citrus and deciduous fruits during the year. Last season about two hundred carloads of oranges were shipped from West Riverside groves. A score or more new residences have been erected in this section, which, like Highgrove, now enjoys the advantages of a free rural mail delivery service.

The government census of 1900 gave Corona a population of 1,434. The actual population is greater by several hundred. This is a prosperous and growing fruit center. Last season's fruit shipments amounted to 600 carloads, about equally divided between oranges and lemons. A large manufacturing plant is operated the year round, turning out vitrified sewer pipe, terra-cotta goods and pressed brick, made of a superior quality of clay found near by. A new water system has been put in operation during the past year, a large supply of water, ample for irrigating and domestic purposes, being carried many miles in pipes and canals. The honey business has assumed extensive proportions. A large acreage is planted to hay and grain in the vicinity. A number of new residences have been built and there is a demand for more. Three large fruit-packing-houses were erected during 1901. A new local corporation, comprising substantial citizens, representing a capital of $100,000, has been organized to build a plant for the manufacture of fancy tiling, fire brick, and electrical goods, at a cost of $25,000. A corporation representing large cash capital is being organized to build the largest cement works in the country.

In the large area of country embracing the Perris and San Jacinto valleys, the year 1901 has been one of progress.

The rapid development of Strawberry Valley as a health resort has done much to stimulate local trade. Idyllwild, a mile above the valley, among the pines, attracts visitors from all over the country. A large amount of money has been expended here in improvements. A considerable acreage of new land has been planted to deciduous and citrus fruits.

The importance of Perris as a commercial center and base of supplies for a mining district has been increased by the rapid development of water during the past two years, and the consequent large acreage of new land put under cultivation. Thousands of acres in this vicinity have been planted to alfalfa alone.

At Wildomar many olive orchards are just coming into bearing, and a plant is being installed for the manufacture of olive oil. A pickle factory has recently been put in operation.

Hemet has a large flouring-mill, fruit-drying plant, and broom factory in successful operation. The shipments of olives from this point have largely increased during the year. Fine raisins are produced in this section, and the grain industry is flourishing.

Moreno, whose progress for years has been retarded by a scarcity of water, will come into prominence this season as an orange-shipping point. It is believed that the season's shipments will not fall short of 100 carloads, and within a year 500 acres of oranges will be in bearing in the immediate vicinity.

The little settlement of Lakeview, with new people at the helm, promises to develop into a thriving community.

Elsinore, famed for the curative properties of its hot springs, has secured a better train service with the county seat, which will add to its popularity. The hotel has been extensively improved. Coal mines are successfully operated, and a superior quality of potter's clay is obtained in the vicinity. The domestic water-system is owned by the city. The water is supplied from hot sulphur wells, pumped into a 400,000-gallon reservoir, whence it is carried under pressure to every house in the city, furnishing all with soft mineral water at a nominal cost. Fine apricots, prunes, olives, and other fruits are raised around the lake. Seven miles distant is the Good Hope gold mine, with a 20-stamp mill and a cyanide plant. During the open season Lake Elsinore abounds with wild ducks of various kinds, making it an attractive place for sportsmen.

Murietta and Temecula, the latter the terminus of a branch of the Santa Fé road, Winchester and Menifee, continue to thrive and prosper.

The flourishing settlement of Ethanac furnishes a striking example of the possibilities of this section, as a result of the progressive work of the Chase Nursery Company, of Riverside, whose enterprise has wrought wonders in the development of the country hereabouts. Inside of two years, a modern and progressive colony has been established, possessing what is undoubtedly the most perfect and complete private irrigation system in the State. An immense quantity of hay is already grown in this vicinity. The colony has an electric plant of the most modern type, which is utilized to generate power for pumping and lighting purposes.

Broomcorn and sugar-beets, which were planted as experiments, have produced profitable crops. A dairy and creamery have recently been established in the vicinity.

Business is booming at Indio, the little health resort that lies below sea-level. A number of artesian wells have been developed recently, and much land in the vicinity has been taken up and placed under cultivation. Watermelons and cantaloupes are extensively grown.

An increased area of land has been planted to deciduous fruits at Banning and Beaumont, located near the summit of San Gorgonio Pass.

The returns from the United States General Land Office, July 1, 1901, give the acreage of unoccupied public lands in Riverside County as over 2,600,000 acres, chiefly mountainous, rolling, and desert.

SACRAMENTO COUNTY.

By WINFIELD J. DAVIS.

Prepared by direction of the Board of Supervisors of Sacramento County.

Sacramento County is among the largest in Northern California; it is virtually the geographical and railroad center of the State. It is nearly as large as Rhode Island, and about from one half to one seventh of the area of some of the other Eastern States.

Sutter and Placer counties bound it on the north, El Dorado and Amador on the east, Dry Creek and the Mokelumne and San Joaquin rivers on the south, and the Sacramento River on the west.

The first civilized settlement in Northern California was in August, 1839, when John A. Sutter established his fort at what is now Sacramento City. The county was organized by the first Legislature; within its confines is the seat of State government; the annual fairs of the State Agricultural Society are held in Sacramento City, and from that city was projected the first overland railroad on the American continent.

STATISTICS.

Area, 987.66 square miles, or 632,108 acres. Lands assessed, 1901, 608,002 acres. Total assessed valuation of all property, 1901, $34,346,017. Total assessed value of mortgages and trust deeds, $1,947,710. Bonded debt, $404,500; annual interest thereon, $18,395. Expended on roads, 1901, $47,322.24. Number of miles of railroad, 93.25. Latitude, north 38 deg. 35 min.; longitude, west 121 deg. 30 min. Elevation above sea level at Southern Pacific depot, Sacramento, 31 feet. Population, census 1900: of county, 45,915; of cities and towns—Sacramento, 29,282; Folsom, 1,309; Galt, 783; Elk Grove, 361; Florin, 104; Oak Park, 2,500; Walnut Grove, 223; Isleton, 162; Franklin, 83; Cosumnes, 109. Number of registered voters, 1901, 11,792.

Number of acres sown for crop of 1901, according to the report of the County Assessor: Of wheat, 109,000; oats, 93,000; barley, 12,000; corn, 1,000; hay, 72,500. Number of acres of grapevines growing in 1901: For table, 5,000; raisins, 800; wine, 9,000; and, in addition, not assessed: under one year old, 1,050; under two years, 1,600; under three, 1,650; under four, 2,000. Number of fruit trees growing in 1901:

	Bearing.	Non-Bearing.
Apple	5,850	1,350
Apricot	26,000	38,000
Cherry	5,400	8,950
Fig	1,300	2,600
Olive	11,050	6,000
Peach	123,000	42,000
Pear	65,000	60,000
Prune (French)	25,000	53,000
Prune (other kinds)	30,000	79,000
Lemon	1,450	800
Orange	20,000	21,000
Almond	31,000	32,000
Walnut	2,000	1,500

School statistics of Sacramento City and County for the year ending June 30, 1901:

	City.	County.	Total.
Number of census children between five and seventeen years of age	5,964	3,383	9,347
Total number of children of all ages	7,892	4,591	12,483
Number of teachers employed, including high school	136	91	227
Number of pupils enrolled in grammar and primary departments	4,699	2,538	7,237
Average attendance	3,634	1,886	5,520
Number of volumes in school library	2,500	24,851	27,351

FINANCE.

	City.	County.	Total.
Amount paid for teachers' salaries	$102,602 85	$49,893 80	
Contingent expenses	16,476 80	12,932 64	
Amount paid for library	536 85	1,580 17	
Sites, buildings, and furniture	13,594 10	4,385 26	
Total expense for year			$202,002 47
Valuation of school property	318,200 00	109,597 00	427,797 00

HIGH SCHOOLS.

	Sacramento High School.	Elk Grove High School.
Number of teachers	11	2
Enrollment	326	30
Number of graduates	34	9
Teachers' salaries	$11,725 00	$1,800 00
Expenditures for year	14,035 20	2,238 33

TOPOGRAPHY AND SOIL.

The area of Sacramento County is almost all a rich alluvial plain from 30 to 75 feet above sea level, gradually rising from the rivers to meet the low rolling foothills of the Sierra Nevada Mountains; these foothills commence at the extreme eastern part of the country, and are from 6 to 8 miles wide. There are no mountains within its confines, and aside from this foothill belt the surface has only gentle undulations.

The Sacramento River traverses the eastern boundary tortuously for about 90 miles across the rich bottoms, cutting them up at the lower part of the county into numerous small and several large islands. The Sacramento is the longest and largest river in the State, and is navigable from beyond Colusa to San Francisco Bay.

The American River rises in the upper Sierras, and enters the county at the northeast corner, among the low foothills. It flows in a southwest direction through the entire width of the county, a distance of some 35 miles, and empties into the Sacramento just north of the capital city.

Thirty miles south of the American is Dry Creek, at the southern boundary of the county. Midway between these two rivers, or 16 miles south of the American, the Cosumnes River flows out from the eastern foothills, and runs through the county southwesterly, and about parallel with the American, dividing the portion of the county south of the American into two nearly equal sections.

The Mokelumne River runs along a portion of the south line of the county. The section lying between the Cosumnes and the south boundary is again divided in about the middle by a watercourse known as the Laguna, that runs nearly parallel with the Cosumnes.

Geological indications prove that in remote ages the entire Sacramento Valley and a section of the foothills to an altitude of several hundred feet were portions of the bed of a vast inland sea or lake, and that into this lake the washings of the surrounding mountains were poured to form the present soils, which are made up of all the fertile mineral and vegetable elements in almost inexhaustible quantities. Many assays have been made of these soils from the alluvial valleys, the upper lands, and the foothills; these assays have demonstrated that the soils of this valley are unexcelled for fertility.

Along the borders of the Sacramento River and around the islands is a belt of sediment land, partly a clayey, sandy loam, of great depth and unexcelled richness, varying in width from half a mile to a mile or more. This deposit has been formed by the overflowing of the stream for countless ages, and has produced a soil as fertile as that of the valley of the Nile. The same quality of soil exists along the lower reaches of the other rivers. The interior of the islands is a sedimentary deposit from the river and its tributaries, diversified occasionally by formations of peat along the lower reaches of the river.

Next to this belt of river-bank land is a strip of tule land considerably lower in altitude. This strip is quite narrow in the northern half of the county, but expands to a width of about fifteen miles at the south. All of these tule lands are naturally subject to overflow in the rainy season, and portions of them, and all of the islands, have been reclaimed and protected against inundation by substantial levees and drainage canals and pumping plants. These reclaimed lands are in a high state of cultivation to fruit, alfalfa, and vegetables.

Thence eastward the surface gradually rises to meet the low foothills, from whose spurs diverge broad, low ridges of reddish loam, gravelly near the hills, and these spurs are alternated with swales having a soil somewhat heavier and less deeply tinted. Southeast of Sacramento City these reddish loam lands are underlaid by a porous and soft material at from two to six feet, and this by an impervious clay.

The belt of foothills is rolling, interspersed with low hills, and its soils are red and gravelly clays, having a scattered growth of oaks.

CLIMATE.

A comparison of the climatic conditions of Sacramento County with those of the great Riviera and the citrus and olive belt of northern and central Italy demonstrates that this county leads that great winter sanitarium of the world. This county shows a warmer winter, spring, and yearly average temperature, and about the same summer and autumn temperature as that of the noted citrus belt of Italy, where it is said "perpetual summer exists, skies are blue, and the sun ever shines." The average number of clear days in this county is 244, being more in a year than for any other inhabited portion of the northern hemisphere, except Yuma. The lowest temperature ever reached here was 19°, and that occurred but twice in fifty years. Snow is unknown, except that about once in ten years there is a slight fall sufficient to measure, and which melts almost immediately. The average winter temperature, according to the United States Weather Bureau records at Sacramento, is 48.3°; average spring, 59.5°; average summer, 71.7°; average autumn, 61.5°; average yearly, 60.2°. The average annual rainfall is 19.94 inches. The winters are equivalent to spring in Ohio, Iowa, Kansas, central Illinois, Indiana, and southern Colorado.

In an able paper on the climate of California, General N. P. Chipman gave in substance the following description of that of the Sacramento Valley: In judging of climate there is nothing so misleading and inconclusive as tables of mean annual temperatures. The mean annual temperature here, where there is seldom a frost and rarely a hot day, is only about 5° higher than that of New York, where people perish both by extreme cold and heat. Mean temperature conveys but a slight idea of actual climatic conditions, and does not necessarily imply either high or low temperatures in summer or winter. The Siskiyou Mountains connect the Coast Range with the Sierra Nevadas on the north of the valley. This lofty battlement on the north, with that on the east, has much to do in warding off the arctic currents and deflecting them from the lower valleys. The Coast Range is higher toward the north than in the southern boundary of the State. It has a height west of the upper Sacramento Valley of 4,000 feet. This range is an important factor in affecting the climate of the upper interior valleys by shutting off the cool sea breezes of summer, as well as by modifying the winds of winter. These ocean breezes of summer, that blow almost constantly, are felt in the Sacramento Valley as they enter at the Golden Gate and follow up the valley. The chief modifier of our climate, however, is the Japan, or great equatorial ocean current, which is deflected northerly and easterly when it meets the coast of Asia. It there divides, and a portion strikes the northwest coast of North America, then turns acutely to the southeast, and flows along the west shore and past California and Mexico. This current has been found to start with a maximum temperature of 88°; at Alaska it is found to be 50.06°; eight hundred miles west of San Francisco, 60.33°; and one hundred miles west, 55.05°. Here is a body of water of an average temperature of 57.89°, and a thousand miles wide, that flows past our shores constantly. Observation shows that from this surface there flows an air current which rarely rises more than two or three degrees above the temperature of the water. This great aerial current that moves with the ocean stream largely determines the climate of California.

The valley climate is characterized by mild winters, warm summers (with occasional hot days), a dry atmosphere, and less rainfall than on the coast. The summers are practically rainless from the middle of May or the first of June to the middle of October or the first of November. The dryness of the atmosphere makes outdoor labor entirely comfortable, even when the thermometer registers 100°—and that is an extreme rarity. The summer nights are uniformly cool and agreeable, and assure refreshing sleep.

As a sanitarium the Sacramento Valley presents unusual attractions. The healthfulness is remarked by all comers. People from the East and West who come here to reside experience renewed vigor and life. It is an erroneous idea, sometimes entertained, that this mild climate begets that lassitude and indisposition to labor so common to tropical regions. That does not follow here. We engage, indoors and outdoors, in all the occupations found in the temperate zone, and with all the zest and ambition that distinguish the American people elsewhere. Another result of great economic value is that every day in the year is a comfortable working day. This cannot fail to impress the industrious and frugal who wish to utilize their capital, which lies largely in daily earnings. Considering our agricultural interests broadly, there is no dormant or idle season, or a period when consumption eats away production, as in countries where severe cold paralyzes productive effort for half the year, or exhaustive heat restricts in a portion of the other half. Intelligent, diversified agriculture admits of no necessarily idle day, and no period without the possibility of adding the productive value of a day's work. With factories or the workshops the same is true. Less fuel, less clothing, uninterrupted work for the year, and greater comfort result from an equable temperature. There is, for the industrious man of moderate means, no more inviting country on the globe than the Sacramento Valley.

IRRIGATION.

The water-supply of the county is unlimited and inexhaustible. The first and most important source is the Sacramento River. The bank lands ordinarily require no irrigation; but at such times as fruit-growers along the river need water it is either siphoned or pumped through pipes from the river by gasoline or steam engines. This river carries an abundance of water at all times, and if necessary the surplus could be utilized to irrigate a large area of the county.

The American affords an unlimited supply at all seasons of the year, and enough flows out of the county and to the ocean to irrigate all of the upper lands in the county, as well as to furnish an unlimited supply of power for manufacturing purposes.

The Cosumnes carries a large body of water in the rainy season, and maintains a good supply in the summer, sufficient to furnish ample for irrigation purposes, however extensive.

The Laguna has a good flow in the winter, and during the greater part of the year is quite a stream, but in the latter part of the season is generally dry.

Dry Creek is quite a prominent stream. It flows a strong volume in the rainy season, and in the driest part of the year gives an ample supply for the farmers along its banks.

The Mokelumne never runs dry, and the topography of the country is favorable to the utilization of its waters.

In addition to the numerous rivers and streams there is, underlying the entire area of the county, an inexhaustible supply of pure and excellent water for domestic and irrigating purposes. Throughout the greater portion of the county this subterranean supply is easily appropriated by means of a light lifting power. South of the American River the entire western half of the county has this supply within eight to ten feet of the surface, while east of that center the depth at which water is reached somewhat increases. By reason of this abundant subterranean water-supply the farmer or fruit-grower who wishes to irrigate his land may do so without being dependent on any canal corporation, and at a trifling cost. For instance, a windmill with two six-inch pumps, will cost about $100, and has the capacity to irrigate five acres in fruit and is often made to answer for eight. Many mills so equipped are used for raising water from wells 18 to 20 feet deep, but gasoline or steam engines and centrifugal pumps are employed in most cases where the need of water is very extensive.

AGRICULTURE—HORTICULTURE.

The first venture in agriculture in Northern California was by General Sutter in 1839. He received a concession of a large tract of land from the Mexican government, and located his fort near the junction of the American with the Sacramento River. His first wheat field was on a portion of the land now covered by Sacramento City. He planted the first grapevines and fruit trees, and practically demonstrated the unsurpassed fertility of the soil of the great valley in the north.

All of the lands of the county are practically arable, and there has never been a crop failure. The up, or red, lands in the eastern part of the county along the Cosumnes River and between that and the Mokelumne River and Dry Creek, and north to and beyond the American River, are devoted largely to the growing of grain and hay and to stock-raising and dairying, though fruit production is also very considerable where irrigation is practiced. Thousands of acres along the river bottoms and on the islands are used for the production of all kinds of vegetables, which are shipped East by the carload, and at times by the trainload. It is impossible to reach even an estimate of the vast quantities that are daily carried to the San Francisco markets by the various regular and trading steamboats which traverse the river. A great deal of this product is disposed of to the canneries in this and other counties. These vegetable lands along the Sacramento often command an annual rental of $50 an acre.

Alfalfa grows luxuriantly without irrigation on all the rich bottom lands, producing from four to eight tons to the acre in the four crops that are cut annually. The average time between the cuttings is from thirty-two to thirty-six days, and for six months the fields are used for pasturage and dairying. The yield of alfalfa hay in 1901 can not be accurately estimated, but it was very large. It finds a ready market, and yields to the producer from $8 to $10 per ton.

Fruits of all kinds are produced on any land in the county, and particularly on the river bottoms and the islands.

The winter fruits are oranges, lemons, pomegranates, olives, and persimmons, which all ripen in November, December, and January. Oranges and lemons ripen here earlier than in the southern part of the State, and are always sold at fancy prices on that account. The Japanese persimmon grows to the size of apples. Olives are very profitable, both for pickling and for oil.

The spring fruits that mature and are marketed in April, May, and June embrace strawberries, raspberries, blackberries, and cherries. Every acre of tillable land in the county will grow the finest berries in profusion, and the crop is very profitable. There is a ready market for the product of 10,000 acres at remunerative prices, though only about 1,200 acres are so cultivated.

After picking his early fruits and collecting the returns, the fruit-grower has to attend to the early summer fruits: apricots, plums, peaches, pears, and nectarines. The first peaches are ready by the last of May, and apricots and the earlier varieties of plums ripen about the same time. From then until October there is no cessation in the picking and shipping of fruit. Peaches are very largely cultivated all over the county, but reach their greatest importance on the river bottoms and island lands. From these districts alone hundreds of tons are marketed every day, during the season, both in California and in the East.

Apricots ripen early, and of all countries in the world California is the only one that has made a thorough success of that fruit, and in this county it reaches its very finest development in size, flavor, and productiveness. Much of this product is canned, and has the entire world for a market.

A large number of varieties of pears are grown, among them the Madeline, Bloodgood, Dearborn Seedling, Le Conte, Buerré Hardy, Seckel, Buerré Clairgeau, Beurré Bosc, Winter Nelis, etc.; but chief among them is the renowned Bartlett. This latter variety is shipped in large quantities to every city of any size in the Union, and is as well known in New York and Chicago and other centers of population in the East as it is at home. It grows on the rich lands of our rivers and islands in larger quantities and to greater size than anywhere else in the world. There has been no instance where an acre of Bartletts, on land suited to their cultivation, has failed, during the past twenty years, to yield a handsome income.

Plums are very profitable. They grow to a large size, and are shipped in vast quantities to the Eastern and home markets and to the canneries. Much of this product is pitted and dried in the sun for the market.

Apple culture is profitable, but this line has been neglected and would justify greater attention.

Nectarines do well, and are cultivated to a considerable extent.

In the fall the fruit products are apples, pears, grapes, quinces, prunes, and peaches.

Sacramento County is preëminently the home of the grape, and on the red lands of the plains it reaches its highest perfection, particularly with irrigation. The table varieties include the Tokay, Muscat, Black Prince, Morocco, Emperor, and Cornichon. They always bring first-class prices for shipment to the Eastern markets. These grapes are profitable at $15 to $20 per ton, but are usually sold at from $40 to $60. The wineries of the State handle quantities of some of these varieties.

French, or petite, prunes are a leading fruit. They are remarkably prolific, and when cured excel the imported article, and bring a much higher price in the markets of the world. They do well on any land that is suited for plums, and are readily cured for market.

Raisins are easily cured, the climate being peculiarly favorable.

Figs grow in any part of the county, but on the river bottoms they reach a great size, and are remarkably prolific. The common black fig requires absolutely no care; the tree is as hardy as the native oak. The first crop is usually sold green, but the second is allowed to fall to the ground, and when dried the fruit is sacked, and readily commands from 3½ to 5 cents per pound. The Smyrna, or "fig of commerce," has been introduced and successfully grown.

Almonds have long been found a reliable and profitable crop. Like the fig, the trees require little or no attention. They can be grown in any part of the county. There is never any trouble to market all that is produced, at very satisfactory prices; in fact, there is an ample field for more extended production of this standard nut.

The English soft-shell walnut has been demonstrated to be a profitable crop. Black walnut trees are extensively grown for shade and ornament. Walnuts will, in time, become an important production in California. So late as the second of February our Federal governmental report from Marseilles, France, indicated that the exportations there had fallen off considerably, for the reason that American buyers are more disposed to purchase from the growers than through commission houses.

Peanuts of excellent quality are profitably grown on the bottom lands.

Broom corn is grown, as is also Egyptian corn—the latter making an excellent and cheap food for stock.

Hundreds of tons of beans of all kinds are produced on the river and island lands. The interior of Grand and Tyler islands is to a great degree devoted to their production.

Potatoes, both sweet and Irish, are grown in large quantities on the bottom lands; of the latter, the average yield per acre is from 100 to 150 sacks.

Licorice has been successfully raised at Florin on the red lands.

Several years ago sugar-beets were extensively grown near Brighton on the upper bottoms of the American River, and a sugar factory and distillery were established; but, while there was a demonstration that the beet could be successfully grown, the manufacture of sugar therefrom proved a failure at that time, because of the inexperience of the management.

Cotton and tobacco have been raised, but not in commercial quantities; and even the tropical banana is grown, but only experimentally.

Time of planting of staple products: December and January, wheat, barley; January and February, oats; February and March, corn, beans, peas, tomatoes.

Time of maturity: June, wheat; June and July, barley, oats; July to September, corn; May to June, beans; April to June, peas; May to July, tomatoes.

Time of maturity of fruit: Bloom—March, apricots, peaches, plums; April, pears, oranges, apples; March and April, cherries; January to March, almonds. Maturity—May to July, apricots, cherries, peaches; June to October, pears; June to November, apples; November to December, oranges; June to November, grapes; October, almonds; June and July, plums.

Time at which trees, etc., come into commercial bearing: Peaches, nectarines, and grapes, three years; pears and plums (considering varieties), two to six; apricots, three to four; apples, five to six; oranges and lemons, two and upward; prunes, two to five; figs, three to five.

SOME HISTORICAL NOTES.

The first good apple trees were imported from Oregon in 1849, but the varieties were few and the trees did not thrive. In 1852, a few trees were brought out by way of the Isthmus of Panama—the beginning, really, of successful cultivation of that fruit. In 1850 apples were sold in San Francisco that came from Van Diemen's Land, or Tasmania; now a considerable quantity of that fruit is shipped, among other places, to Australia from California. In 1847, Henderson Lewelling crossed the Rocky Mountains to Oregon with a wagon-load of well-selected fruit trees. That is said to be the first stock of fine varieties of temperate fruits on the Pacific Coast.

An orange tree began growing near Marysville in 1852. The first orange tree was planted in Butte County in 1859, and soon afterward another was set out at Oroville. The seeds from which these pioneer orange trees of Northern California grew were obtained from two oranges eaten in Sacramento. One was from Acapulco and the other from Italy. The trees had been growing five years in Sacramento, when they were transplanted. Sacramento is considered the primary home of the orange in Northern California. Not only were the two trees spoken of taken from here, but many of the oranges grown in Placer County in an early day sprang from a seed which Rev. N. R. Peck carried from Sacramento in 1862 and planted at his home in Ophir. It was not until 1874 that trees began to be planted for profit, and that it became generally known that their cultivation could be made a commercial success.

Some of the first peaches known in the market of Sacramento came from a small orchard at Coloma, the scene of the discovery of gold; the trees had been planted by Mrs. Wimmer, who had brought some pits across the plains, and in 1853 her little orchard produced quite a quantity of fruit. In 1854–5 she sold in Sacramento some forty or fifty peaches for 25 to 50 cents apiece. About the 20th of July, 1854, A. P. Smith, of the famous "Smith's Gardens," just east of Sacramento City, on the American River, brought to that city six peaches which he had raised in his orchard, and they were sold by W. R. Strong for $2 apiece.

Tobacco was first raised at Sutter's Fort in 1841–2 from seed sent out by W. G. Ray, of the Hudson Bay Company, to General Sutter as a present.

FRUIT SHIPMENTS.

Sacramento City, by reason of natural advantages, geographical relations to various producing sections, and admirable transportation facilities, deservedly bears the reputation of being the largest fruit and vegetable shipping point in the State. It is the recognized outlet for the products of Northern California. Within the borders of Sacramento County every character and variety of agricultural, horticultural, and viticultural products thrive, and in abundance; their excellence commands universal and unlimited demand from many portions of the civilized world.

The fruit crop of 1901 was one of the largest known in the history of the county. As characterized by producers and shippers, it was the banner year, so far as production and remuneration were concerned. And in truth this remark applies to the State, for the value of the exported horticultural products exceeded the combined yield of our gold and grain. The value of the fruit crop of the State for 1901 is conservatively estimated at more than $40,000,000. At one time wheat was the staple production, but of recent years there has been a marked decrease in that line, and lands that had been devoted to its growth are now used for fruit and grapes, with much more advantageous results. Referring to the fruit product of the State of California of 1901, George B. Katzenstein, manager of the Earl Fruit Company, said:

"The figures, about $40,000,000, are but an approximation, but when the year's record is completed and computed, you will find them conservatively made, and indeed, if anything, underestimated. For convenience I have used round figures, and for a better understanding have reduced them to carloads, as follows:

Fresh citrus fruits	600,000,000 pounds, or 25,000 carloads.
Fresh deciduous fruits	175,000,000 pounds, or 7,000 carloads.
Canned deciduous fruits	135,000,000 pounds, or 2,700 carloads.
Dried raisins	75,000,000 pounds, or 3,100 carloads.
Dried prunes	60,000,000 pounds, or 2,500 carloads.
Other dried fruits	60,000,000 pounds, or 2,500 carloads.
Dried figs	5,000,000 pounds, or 200 carloads.

"While many of these products are more valuable, an average worth of $1,000 per carload would more than produce the figures I have made. Nor have I included our nut crop, which I estimate as follows:

Walnuts	14,000,000 pounds, or 640 carloads.
Almonds	2,500,000 pounds, or 100 carloads.

"And so we might go on and add olives and other products of smaller present value for chinking to fill in the interstices of the estimate. It will be observed, therefore, what gigantic proportions the fruit industry of California assumes when it is figured out. And the end thereof is not yet, as it is now only well started."

During 1901, 1,250 carloads of green deciduous fruits wereshipped from Sacramento County, each car averaging from twelve to thirteen tons. These shipments were distributed in every quarter of the United States, Canada, and Mexico, and a large quantity was marketed in London, Glasgow, and other European cities. In the East, Chicago, New York, Boston, Philadelphia, Pittsburg, and Montreal are regular auction points at which fruit is sold for consumption there and in surrounding cities and towns. Between here and those auction points our fruits are sold on the f. o. b. plan, the dealers buying one or more carloads; and thus the distribution is practically all over the United States.

This fruit consists of all the deciduous varieties, such as apples, apricots, peaches, pears, plums, nectarines, and all the varieties of shipping grapes: Muscat, Tokay, Emperor, Cornichon, Ferrara, Verdel, and others.

The highest priced fruit in 1901 was the Bartlett pear. Each pear was a "golden nugget," and sold in the Eastern auction markets at an average of more than $2 a box. The Sacramento River district is peculiarly the home of this magnificent pear, and from that district alone 125,000 boxes were shipped during the season. The demand for this pear is unlimited, and the California product is without competition in the markets of the world. What we know and sell as the Bartlett pear originated in France, and came to us through English sources. Under our favorable climatic conditions it has outstripped the parent tree, and we are shipping the fruit back to the country of its nativity in a state of greater perfection. In the London market California Bartletts in half boxes of twenty-five pounds each are sold for $2.50 or $3.00. The freight costs about 85 cents, so that the profit is handsome.

Plums and peaches in twenty-five-pound boxes find ready sale in England and Scotland. The fruit reaches the European market in perfect condition, being specially packed and carefully refrigerated. It is landed and marketed in London and Glasgow within three weeks after leaving Sacramento.

A remarkable record was made in cherries in 1901. They sold in the Eastern markets higher than ever before, many lots bringing

75 cents per pound in bulk. It is not unsafe to say that the entire California cherry crop that was marketed in the East sold at an average of $1.50 a box, or 15 cents a pound.

It may be said that the production of citrus fruits in Sacramento County is in its infancy. Oranges grow on any of its soils to perfection, and in late years extensive orchards have been planted. The establishment and phenomenal success of the colonies at Orangevale and Fair Oaks, where land of supposed inferior quality has been demonstrated to be peculiarly adapted to citrus and deciduous fruits of all kinds, were incentives to the planting of fruit trees, and a very considerable area of the county that had been devoted to grain-raising and grazing has been planted in orchards. From 75 to 100 carloads (362 boxes to the car) of oranges were sent out in 1901. Large quantities were also sold locally in Sacramento and San Francisco. They go to the latter city by steamboat, by express, and by train. It is safe to say that there are, in orchard form, from 75,000 to 100,000 orange trees in the county. The dividing of large holdings, now being made, means that a great many more will be added.

The production of lemons and grape-fruit is not nearly as great as the demand warrants, although they do fully as well as the orange, and can be raised on any of our lands. At Fair Oaks and Orangevale particularly fine specimens of both of these fruits are produced, and in a short time they will become an important industry.

DRIED FRUITS.

We are indebted to Castle Brothers for an estimate of the amount of dried fruits produced in Sacramento County in 1901, and for other matters of interest in connection with this character of product. This firm handles most of the dried fruit produced in the county, and indeed a large part of that produced in the State. The product of this county last year, of dried peaches was about 800,000 pounds; of pears, about 300,000 pounds; of apricots, about 200,000 pounds; of nectarines, about 8,000 pounds; of pitted plums, about 12,000 pounds; of apples, about 250,000 pounds; of figs, about 30,000 pounds; and of French prunes, about 1,000,000 pounds. These are all sun-dried by the growers; artificial evaporators not being used at all. The dry atmosphere is specially suited for the drying of fruits, and the article so produced is regarded as first class in the markets of the world. The prunes raised on the American River are the finest in the world, and are everywhere so regarded. Recently large consignments were loaded for Ireland, Scotland, England, and Denmark. They are also sold all over the United States and Europe. The foreign trade is large. A very respectable portion of the product goes direct to France, astonishing as that might seem. In 1900 ten carloads were shipped to Paris direct from California in a single consignment. Last season Hamburg was the principal foreign market. The producers received for their dried peaches in 1901 an average of over 5 cents per pound, cash in hand at the bins in the orchards; for their prunes, an average of over 3 cents net; for their apricots, an average of over 8 cents net; for their apples, an average of about 3½ cents net; and for their nectarines and pitted plums, about the same as for peaches. About fifteen carloads of raisins were shipped out of the county during the last season.

All of the fruits named find a ready market all over the world. The figures given above for the past season are not to be considered as a fair estimate of the average yearly production, from the fact that the green fruit market was very active and took larger quantities than ever before at gratifying prices, and the consumption by the canneries was greater than in any former year. The output, especially of prunes, in 1900, was nearly double that of 1901. In 1900, Castle Brothers handled 100 twelve-ton cars of prunes, as against 40 fifteen-ton cars in 1901. In the opinion of experts the climate of this county is especially favorable for the production of peaches and prunes, where the proper varieties are planted, and a partial failure is seldom known.

About 200 tons of almonds of superior quality were produced, and about 25 tons of walnuts. For the almonds the producers received an average of over 9 cents per pound, and as high as 12½ cents for the choicer varieties, cash in the orchards.

THE CANNERIES.

There are three canneries in the county. Two of them are branches of the California Fruit-Canners' Association—one located in Sacramento, and the other at Trask's Landing, on the Sacramento River, about 26 miles below the city. These are two of thirty-two plants owned by the Association at various points on the coast from Los Angeles to Portland, Oregon. A third cannery, belonging to the Central California Canneries, commenced its operations in 1901. This company has an extensive plant in Sacramento City, and, like the others, did a prosperous business during the season. These three canneries sent out a pack of about 200,000 cases last year. In the packing season some 1,500 persons (men, women, and children) are employed. The cannery at Trask's Landing packs asparagus only, and its output was about 30,000 cases in 1901. The packing of asparagus begins on the 15th of March, of strawberries about the first of May, of cherries the first of June, of apricots and blackberries about the middle of June, of peaches and pears about the middle of July, and of tomatoes the middle of September. Plums and other fruits and produce are also packed. The packing continues from the 15th of March until the 20th of October. The Central California Canneries does not pack asparagus, but handles all other character of produce. The Sacramento cannery runs longer than any other in the association. The average prices paid to growers are: for peaches and pears, $30 per ton; plums, $20; apricots, $25; asparagus, 3 cents per pound; cherries, 5 cents per pound. In this county about 300 acres are cultivated in asparagus, and the total pack last season was in the neighborhood of 60,000 cases, but large quantities are sold in the markets here and in San Francisco. The returns per acre are about $300 gross. The fruit and vegetables packed at these canneries are marketed all over the world, being shipped to China, Japan, India, Europe, Mexico, Alaska, and to all points throughout the United States. There are not enough blackberries and strawberries produced and available to supply the demands of the canneries, because of the large quantities that are shipped in the fresh state.

STOCK-RAISING AND DAIRYING.

Sacramento County presents great opportunities to the livestock breeder and the dairyman. The climate is so even, temperate, and mild that animals remain in the open air, practically unsheltered, the year round without hardship. The soil, because of its richness, is peculiarly adapted to the growth of forage crops, especially alfalfa, which is at the same time one of the best and the cheapest of stock feeds. Because of the economy with which livestock can be maintained and the cheapness with which food can be produced, there is a large margin of profit in breeding and rearing farm stock. Animals mature early and produce heavily, and their judicious breeding has been profitable.

There are many extensive creameries in the county, with a considerable butter and cheese output. It is estimated that the butter production of the county is 25,000 pounds per week, and the butter sells at an average price to the producer of over 20 cents per pound.

The average character of the dairy stock in the county is fair, and is being constantly improved by the introduction of well-bred animals. The average production of butter per cow per year is not high, but the conditions here are favorable for a very large product. The breeding of pure-bred pedigreed cattle is engaged in by several persons in the county, but not as extensively as the profits of the business would seem to render advisable. There is a good field in Sacramento County for a breeder of pure-bred dairy animals.

The dairy product of California has heretofore been quite insufficient for the supply of the home demand, and as a consequence better cheese as well as eggs and cured meats have been imported. This short supply has insured profitable prices. Butter manufactured in creameries in Sacramento County has been sold in Alaska, British Columbia, Washington, Oregon, Idaho, Montana, and Arizona, with some few shipments to the Philippine and Hawaiian Islands, China, and Japan. Most of the cheese is produced in the southern portion of the county, on the Cosumnes River, where there are eight factories. The product is sold at an average price of from 9 to 11 cents per pound, and amounts to about 25,000 pounds per month.

While the farmer as a rule raises more or less stock, the production of beef cattle is not sufficient to supply the demand for meat in the county, and most of the beef comes from the northern coast, principally southern Oregon. What stock is produced finds a ready sale at good prices.

Sheep are raised in the section north of the American River and in the southern and eastern portions of the county. From May to October these sheep are pastured in the mountain ranges of the Sierras. There are estimated to be about 100,000 head of sheep in the county.

Hogs are raised generally by the farmers, and several breed pedigreed Poland-China, Berkshire, and Essex swine quite extensively. The breeding of pedigreed hogs has been very profitable.

The conditions are very favorable to the raising of poultry, which business is very remunerative. At Elk Grove poultry-raising is made a specialty, where, on one five-acre tract, three or four thousand chickens are maintained. Many persons in the county breed fancy poultry—all the leading varieties being represented. The conditions are so favorable to the raising of poultry that the business could be made very profitable on a small outlay of money. Owing to climatic conditions, they require comparatively little attention; the market is convenient and prices are always remunerative.

STOCK FARMS.

No State in the Union has more complete and valuable natural advantages for the growing of stock than has California, and it can not be long, if present indications mean anything, when she will take precedence, even of the far-famed Kentucky, in the number and extent of her foaling farms. Indeed, it has come to pass that no race in the broad East, from New Orleans to New York, is considered worth material attention unless it has one or more representatives from the great stock farms of the Golden State. It is with peculiar pride that the people of Sacramento County call attention to the fact that the most famous stables of the State are within her borders. Located in this county, and only a few miles from the State capitol, is the largest stock farm devoted to thoroughbred horses in the world. Reference is particularly made to the great breeding farm at Rancho del Paso, to the north of the city of Sacramento. Here the thoroughbred and trotting and draft horses are brought to their highest degree of perfection, and all over the nation their fame has gone. The State of Kentucky can not, in its highest glory, boast of so far-famed and extensive a breeding farm as this. California has other noted stock farms, and it may be said, with a bold challenge to all disputers, that they are not to be excelled by the best in England or America. And why should not this be true? Here is the most superb of climates; here can be grown the choicest of feed; here there is every incentive in the realm of nature for the production of the highest types of the breeder's skill. The days are rare or never come when the finest horses may not be exercised, and the climate is likewise decidedly in favor of the fast possibilities of the young and growing animal.

The Rancho del Paso, five miles north of Sacramento City, contains 44,000 acres. John Mackey is the superintendent, and it is since he assumed its management that Rancho del Paso began to take the foremost position it now commands. The trotters and thoroughbreds are kept in different parts of the farm, and good exercising tracks are maintained for both. The horses from Rancho del Paso that have been heard of in the East are too well known to need mentioning, and it is enough to know that they have gallantly maintained the claims of Sacramento County as the bright particular spot in California for the development of the finest thoroughbred horses. The annual sales of these horses at home, in the East, and in Europe have come to be considered great opportunities for lovers of the horse, and the prices realized satisfactorily demonstrate this appreciation.

The splendid Rancho del Rio, four miles south of Sacramento City, is also well known. No site could be more delightful. The stables, track, and residences are situated on a knoll rising several feet above the surrounding ground. This farm was established by Theodore Winters, who bought the unbeaten Norfolk for $15,001, and thus laid the foundation for a stable which became famous. From this ranch came some of the best horses known to the turf, such as the Emperor of Norfolk, El Rio Rey, and many others of high class. It was the home of Joe

Hooker and the grand broodmare Marion. The present lessees, Burns & Waterhouse, have a select few which they breed for their own use to race, and not for the market. M. C. Hubbell is the superintendent.

The County Down Stock Farm is owned and managed by Thomas Fox. It is located three quarters of a mile east of Sacramento City, and has been established only about four years. The leading stallion is imp. St. Avonicus, a son of St. Savior.

In Sacramento City, at the grounds of the State Agricultural Society, is the fastest and best track in the State, one that is a great favorite with horsemen ambitious to make a record for their stud.

PRODUCE.

The following is a careful, and, we believe, conservative, estimate of the produce crops of the county in 1901: Of potatoes, the production was fully 1,000,000 sacks; shipping season commences the first of May; marketed throughout the entire section west of the Mississippi River and the Great Lakes; prices paid to producers by shippers, 65 cents to $1.25 per hundred pounds.

Cabbages (raised all the year round), about 150 carloads; shipped from May to July to above markets; prices to producers, from 50 cents to $1 per hundred pounds.

Onions, about 250,000 sacks; shipped from June to November to above markets; prices to producers, from 65 cents to $1.25 per hundred pounds.

Beans, about 1,000,000 sacks; harvested in September and October; shipped all over the United States and universally abroad; prices to producers, from $2 to $2.75 per hundred pounds.

Root products—carrots, turnips, and beets—about 150,000 sacks; sold mostly in this State.

The butter product is mostly sold for State consumption. Cheese is extensively manufactured, and a considerable quantity is exported. Eggs are disposed of in the California markets, though at certain seasons are shipped in carload lots to the Western States.

Asparagus, cauliflower, radishes, celery, lettuce, and other vegetables are produced in enormous quantities. They are mostly for local and State consumption, although some is shipped East in mixed carload lots.

Most of the tomatoes are used locally and by the canneries. Considerable, however, is shipped in carload lots to the Western States.

GRAIN AND HAY.

The estimates of the grain production of the county are based on the reported acreage planted, the number of sacks sold, and the statements of buyers and produces. They are approximately correct. Of wheat, the production in 1901 was about 800,000 sacks; of barley, about 170,000 sacks; of oats, about 200,000 sacks; and of corn, about 16,000 sacks. The number of tons of hay produced was about 50,000; the prices realized by producers were from $8 to $10 per ton.

WINES AND BRANDY.

There are nine wineries in the county—the California, Kohler & Vanbergen's, Nevis's, and the Eagle in the city; one at Elk Grove, one at Bruceville, one at Folsom, one at Orangevale, and one at Natoma. The product in 1901 was 100,000 gallons of sherry, 250,000 gallons of port, 50,000 gallons of angelica, and 200,000 gallons of claret. Of brandies, 50,000 gallons were produced. The output is shipped all over the world, and is principally disposed of in the United States, Central America, and the Islands. The average price paid to the growers for the grapes was $20 per ton.

HOPS.

Along the Sacramento, American, and Cosumnes rivers are the most productive hop fields in the United States. Hop culture on this coast dates back to 1858, when the first roots were imported from Vermont by Daniel and Wilson Flint and planted in Alameda County. Hop culture developed slowly, because of the prejudice of brewers against a hop that contained so much greater percentage of strength than that which they had been accustomed to use; but in time they found that it did not take as much for a brewing. It was early demonstrated that the soil and climate of Sacramento County were unsurpassed for hop culture, and that it is the only place known where a crop of from 1,000 to 2,000 pounds per acre can be grown the first year the roots are planted. It is a common occurrence to grow 2,000 or 3,000 pounds on an acre of ground, and in some instances 4,000 pounds. The cost of picking is from 80 cents to $1 per hundred pounds; 28 or 30 pounds of dried hops are obtained from 100 pounds of green, and a bale averages from 180 to 200 pounds. From the stock imported by the Flint brothers the roots in Oregon, Washington, and throughout California were obtained. In one year $3,000 worth of roots were sold from their yards. In 1901, 1,255 acres were planted in hops in Sacramento County. The average price realized by the growers is from 8 to 10 cents per pound. The crop is shipped to all parts of the world, but is consumed principally in the Eastern States and England. About 6,000 bales are used by the local market. Hop land is held at from $150 to $500 an acre, and some of it is not for sale. The total number of bales produced in Sacramento County in 1901 was 10,800.

RAIL AND RIVER TRANSPORTATION.

Few counties in the State contain a greater mileage of railroads than does Sacramento County. From the capital city the Central Pacific leads eastward across the continent; the California & Oregon passes to the north into Oregon, and from thence to Washington, and also to the Eastern States; the Western Pacific, which terminates at Oakland, connects also with the Southern overland line at Lathrop, and at the flourishing town of Galt a branch line runs up into the rich county of Amador; the California Pacific runs on the west of the Sacramento River to Oakland; and the Sacramento & Placerville passes along the American River through Folsom, and thence into the historic county of El Dorado. From most all of these roads branches extend into the various counties of Northern California. From its geographical position, Sacramento City is the natural railroad center of the central and northern portions of the State, and the agricultural and mineral products of this great and rich section of the American Union are shipped from her ample storehouses.

The Southern Pacific Company operates two steamboats that make daily trips between Sacramento and San Francisco, touching at the various towns and farm landings to receive and discharge freight.

The Sacramento Transportation Company operates eight steamboats and twenty-five barges that are run between Red Bluff and San Francisco. They touch at all landings, and move a great part of the grain that is produced in the up-river counties, as well as all other kinds of freight.

The Farmers' Transportation Company started operations last year. It is controlled by an association of farmers. It has one steamboat (the Valletta) that runs between Colusa and San Francisco, making weekly trips; she also touches at all landings, and has moved a considerable amount of freight during the season.

MANUFACTURES.

Sacramento City, being the center and metropolis of the richest portion of the State, the heart of a vast railroad system, the point from which steamers pass to the north and to the south, and with unlimited water and electrical power at her very doors, presents advantages in manufactures equaled by no other city on the coast. Here are located the extensive shops of the Southern Pacific Company, where 3,365 men are employed, and in which the company builds its own cars and general rolling stock, and does its own repairing. These shops occupy some twenty-five acres. Four flouring-mills are operated—three in the city and one at the town of Brighton near the American River. The city mills are run by electricity, and that at Brighton by steam, with oil fuel.

The Sperry Flour Company (Pioneer Mills) in 1901 manufactured 180,000 barrels of flour and 1,200 barrels of meals; also 4,000 cases of germea of eighty pounds to the case, and 18,000,000 pounds of feed. The flour product is sent to China, the Hawaiian Islands, Japan, and the Philippines. The Oriental trade is handled through a branch house at Hongkong. About one-half of the flour made is consumed in California.

The Phœnix Milling Company in 1901 manufactured 75,000 barrels of flour, 5,000 barrels of meals, and 8,000 tons of feed. Most of the product is disposed of in California.

The Valley Milling Company commenced operations July 27, 1901. The capacity of its mill is 80 barrels of flour a day, and 10 or 12 tons of barley.

The mill of the Brighton Milling Company at Brighton was established in July, 1899, and has a capacity of 125 barrels per day. In 1901 it manufactured 33,000 barrels of flour, and from 1,500 to 2,000 tons of feed. The product is disposed of all over the State.

The millers have several advantages of location. Wheat can be bought here as a rule at a dollar a ton less than the ruling rates in San Francisco, and consequently the flour can be produced cheaper. Much of the grain is hauled to the mills by the farmers in wagons, or is brought down the Sacramento on large barges. Power is cheap.

There are two large breweries in the city. The City Brewery manufactures steam beer, and in 1901 produced 50,000 barrels that were disposed of all over California, Nevada, and Oregon. The Buffalo Brewing Company has one of the largest and most complete lager beer plants on the coast, and last year it turned out about 50,000 barrels that were shipped to all parts of the coast.

The manufacture of brick is a very important industry. The supply of the best soil to be found anywhere for the purpose is inexhaustible, and Sacramento County brick has a name all over the coast.

The Capital Manufacturing Company, at Sixth and H Streets, has a factory that is equipped with the latest modern machinery, and it manufactures all kinds of furniture. Its factory is run by electrical power, and in its employ are twenty-seven men. In 1901 the volume of its manufacture was $164,600, and the product was sold locally and in other parts of California, Nevada, and Oregon.

Among the prominent manufactories of Sacramento is the Schaw-Batcher Company Pipe Works, located at Fifteenth and B streets. Here the company has erected substantial iron buildings, which cover about half a block. The business consists in manufacturing riveted iron and steel pipe for irrigating, mining, and power purposes. The works during the past year employed from fifty to seventy-five men steadily. The output for 1901 was over fifty miles of pipe, ranging from four inches in diameter up to six feet, in the manufacture of which was used over three million pounds of steel. The works are equipped with all the latest devices in improved machinery, and they are manufacturing pipe ranging from the thinnest sheets, for the conveyance of air, up to pipe five eighths of an inch thick, for power plants working under great pressure. The company takes contracts to make and lay power lines, and has the credit of having installed some of the most important electric power lines in the State, among which are the following: Central California Electric Company, Auburn; Central California Electric Company, Newcastle; Keswick Electric Light and Power Company, Shasta County; Tuolumne Water and Power Company, Sonora; Columbia Electric Power Company, Tuolumne County; Bay Counties Power Company, Brown's Valley; Big Creek Power Company, Santa Cruz; Copley Electric Power Plant, Shasta County; Jumper Power Plant, Quartz Mountain, Tuolumne County; Placerville Electric Light and Power Company; Bell Electric Company, Auburn; and many other heavy lines. The company sends its products all over California, Oregon, Washington, British Columbia, Alaska, Idaho, Utah, Montana, and the Hawaiian Islands.

The A. T. Ames Pump Manufactory is located at Galt. The works are the largest and best equipped of their kind west of the Rocky Mountains, and the only works on the Pacific Slope devoted exclusively to the manufacture of deep-well pumping machinery, hydraulic machinery, hydraulic packings, etc. The principal product of manufacture is the Fulton deep-well pump, which was designed in the shop of Mr. A. T. Ames and is distinctly a California product. Two styles of this pump are built—the variable motion double-plunger type, and the single-acting type. The Fulton variable motion double-plunger pump has been in use for over five years, and fills a place not occupied by any other pump on the market. The products of Mr. Ames's shop have found a market wherever pumps are used, and the increasing demand for them is convincing proof that they give entire satisfaction. He has been compelled in the last year to increase the facilities for manufacturing his goods to keep pace with his growing trade, which now extends from Washington to Texas and to the Hawaiian Islands and Australia.

The Mohr & Yoerk Packing Company employs fifty-two men. In 1901, 11,000 hogs were killed; live weight, 2,200,000 pounds; cost, $126,500; price paid for live hogs, from 5¼ to 6¼ cents per pound. These hogs were all purchased in Northern California—Sacramento, Yolo, Colusa, Glenn, Sutter, Solano, Butte, Tehama, Yuba, and Amador counties, with a small number from other counties. More came from Glenn than from any other county, and presumably the raising of swine is made more of a specialty there. The Sacramento County hogs are, however, superior to those raised elsewhere, and particularly is that the case with those from the Cosumnes, where the excellent quality of the corn contributes to the production of the finest quality of pork. On the arrival of the hogs at the stockyards of the company they are inspected by the Government inspector appointed by the county, and his decision is final. Beating or otherwise exciting or disturbing the animals is strictly prohibited. After killing, the carcasses are hung in the chill-room for twenty-four hours in a temperature of 35° Fahrenheit, and then hauled to the packing-house, where they are cut up and trimmed into hams, shoulders, and sides. These are packed in tierces and large tanks and covered with sweet-pickle until cured; then, hung in the smokehouses and smoked for three or four days. All of the smoked meats are branded "Columbia." They are marketed in Northern California, and a small quantity in Nevada. In 1901 the pack consisted of 22,000 hams, weighing 264,000 pounds; the same number of shoulders, weighing 220,000 pounds; the same number of sides of bacon, weighing 451,000 pounds; and of lard, 385,000 pounds. Other products of weight 500,000 pounds, such as pickled pork, pigs' feet, fertilizing material, etc., were also output. Of fertilizer, about 200 tons was manufactured, and the supply is by no means equal to the demand. The material is disposed of in the northern part of the State and in the Hawaiian Islands.

But the great and overshadowing superiority the city possesses is the unlimited cheap power that is afforded. For years the great power of the swift-flowing American was allowed to go to waste, but in 1888, at the Folsom State Prison, twenty-two miles from Sacramento City, a mighty granite dam was constructed across the river. At that point solid bluffs of rock rise on either side, affording a splendid site. The corner-stone for the structure was laid September 14, 1888, and the work was vigorously prosecuted. The greater portion of the work was performed by the State's convicts. The dam has a base of 87 feet, is 89 feet high, 650 feet long, and 24 feet wide at the top. A wing 130 feet wide turns the water into a canal 40 feet wide at the bottom and 50 at the top and 8 feet deep, that extends to the town of Folsom, a distance of about a mile and a half, giving a fall of fully 70 feet at that point. The natural fall of the American gives as great a force as any other stream west of the Rocky Mountains, and the artificial assistance rendered by the dam creates added power. From the canal the water falls upon turbine wheels. Five large generators produce the electric power, and it is transmitted to Sacramento City by four circuits on two sets of poles, so as to guard against breakages and accidents. The current is received at the substation at Sixth and H streets, and from thence transmitted over the various circuits in the city. The distance of the generators from Sacramento is 22.4 miles. The Sacramento Electric, Gas, and Railway Company receives and controls this power. Each of the five generators produces one thousand horsepower. In addition, the company receives current at 40,000 volts from the Bay Counties Company power plant that is located on the North Yuba, 35 miles above Marysville. This power is transmitted to Sacramento over a circuit 64.2 miles in length. With the combined power so received the street car lines of the company in Sacramento City and suburbs are operated. These lines are 24.5 miles long, and are regularly traversed by twenty-one cars, with four extra cars when demands of business require. The public lighting of the city is from this source. The company supplies eight hundred arc lights for street and commercial purposes and thirty-five thousand incandescents. It also furnishes an aggregate of over three thousand horsepower for manufacturing purposes in and about the city, including printing offices, machine shops, elevators, planing-mills, flouring-mills; also, irrigation and dredging plants, and many other industries.

The Central California Electric Company derives its power from abrupt drops in the canals of the South Yuba Water Company, located in Placer and Nevada counties. The water company has an immense storage system for municipal supply, irrigation, and water power, and it maintains twenty reservoirs on the divide, or in the upper foothills, thirteen distributing reservoirs in the lower foothills, four hundred miles of canal (three hundred of which will carry one thousand miners' inches), besides many miles of flumes, pipe-lines, and tunnels. The whole forms a vast network over Placer and Nevada counties, stores two billion cubic feet of water, and sustains the flow of six thousand miners' inches for one hundred and fifty days of drought. The electrical power-houses of the Central California Electric Company are at present two in number—at Newcastle, in Placer County, 28 miles distant, and at Auburn, also in Placer County, 33 miles distant. Their aggregate output is nearly two thousand horsepower. A third power-house at Alta, 65 miles from Sacramento, in Placer County, is in course of construction, and the output of the two great generators for this station, now being built by the Westinghouse Electric and Manufacturing Company, will be three thousand horsepower, which will be available in the fall of 1902. The Central California Electric Company supplies thirty firms using power, and illuminates Newcastle, Penryn, Loomis, and Rocklin, in Placer County, and about fifteen hundred light consumers, its incandescents amounting in the aggregate to about fifteen thousand. The building of the new power station at Alta has been the result of ever enlarging demands of custom. The undeveloped resources of the South Yuba Water Company, now at the disposal of the electric company, are immense, and any amount of power desirable can be transmitted by the latter in electric current to Sacramento from distances not over seventy miles.

Aside from the manufactories specified, there are in the county 2 broom factories, 1 berry-box factory, 6 abattoirs, 1 bag factory, several boot and shoe factories, 2 boiler shops, 3 box factories, 3 brick yards, 15 bakeries, 8 bottling works, 1 barley mill, 1 horse-collar factory, 4 carriage factories, 5 candy factories, 2 cracker factories, 3 manufacturing chemist establishments, 2 coffee and spice mills, a number of cigar factories, 1 cooper shop, 1 excelsior factory, 3 foundries, 2 fertilizing material works, 2 glue factories, 1 gas works, 3 granite and marble works, 12 harness and saddle factories, 1 hop compress, 1 iron-fence works, 4 manufacturing jewelers, 1 marmalade plant, 2 metallic cornice works, 1 malt and meal mill, 2 mattress factories, 5 meat-packing establishments, 1 macaroni factory, 7 machine shops, 1 match factory, 3 olive oil plants, 2 pipe works, 7 planing mills, 7 printing offices, 2 pump factories, 4 pickle factories, 2 potteries, 1 plaster works, 2 soap factories, 3 shirt factories, several sausage factories, several tin shops, 2 tile works, 2 trunk factories, 2 tent and awning factories, 1 threshing-machine tooth factory, 1 telephone antiseptic mouthpiece factory, 1 wheel factory.

A natural-gas well supplies nearly half the City of Sacramento, and other wells are being sunk to increase the supply.

FISH AND GAME.

The natural fish in the rivers are salmon, sturgeon, pike, perch, hard-heads, and dace. Those planted are striped bass, black bass, shad, and three kinds of catfish. The only fish propagated is the salmon, in the headwaters of the Sacramento. The most important fish to be protected is the perch. At present there is no law for its protection, and for a time this variety was nearly exterminated, but of late it has shown up finely. All of the planted fish have multiplied satisfactorily. In the open season large numbers of salmon and other fish are taken and sold in the local and San Francisco markets.

In the line of game, there are geese, ducks, quail, curlew, doves, and larks. All but the geese are protected by State law. The wild geese are migratory, and they arrive from the north from the 15th of September until about the last of October. The varieties are the honker or Canada, the speckled-breasted brant, two of the white brant, the Mexican or black, and the China. The ducks are mostly migratory. Of the non-migratory species are the mallard, spoonbill, and wood duck. The migratory ducks that come from the south are the red-head and the blue-winged teal; and from the north the green-winged teal, widgeon, sprig, canvasback, gadwell or gray duck, blue bill, and black-jack.

ROADS AND BRIDGES.

One can drive in any direction, at any time of the year, with no inconvenience, over roads that favorably compare with the streets in many towns elsewhere in the State. All of the bridges and roads are free for travel.

The Sacramento River is spanned at the city by a new bridge, and lower down several ferries are maintained. The American is bridged north of the city on a line with Twelfth Street to connect with Placer County; at Fair Oaks; above at Folsom, to reach the county of Placer; and still farther at Mormon Island, to connect with the county of El Dorado. There are four bridges across the Cosumnes—one at McCracken's, one at Live Oak, one at McConnell's, and the fourth at Michigan Bar. Across the Mokelumne is a bridge at Benson's ferry, connecting with San Joaquin County, and a ferry connecting Staten and Tyler islands. Recently a new steel drawbridge was erected spanning Georgiana slough, and connecting Andrus Island with the main land at Walnut Grove.

The county authorities have experimented with bituminous oils on the roads, with a view of laying the dust in the summer and of preserving their integrity during the winter months. It has proven to be practicable, economical, and lasting in its effects. The intention is to pursue this method of treatment on all the main traveled roads.

DISTRICT NORTH OF THE AMERICAN RIVER.

The lands along the lower reaches of the American River are generally similar in soil qualities to those along the Sacramento. The fringe of bottom land will produce anything in the line of fruits, vines, or vegetables, and in profuse quantities. Hops are extensively grown. About 100,000 sacks of potatoes of superior quality were raised in 1901. Alfalfa cuts four crops a year, producing about seven tons an acre per annum; the balance of the year the lands are pastured to stock. Prunes and table grapes are grown to perfection, and find a ready market. On the red lands, oranges, lemons, peaches, pears, plums, and other varieties of fruit, grapes, both table and wine, and almonds are grown. North of the Haggin grant there are several extensive orchards and vineyards, but most of their fruit and table grapes is shipped from Placer County. The wine grapes are esteemed superior to any other produced in the county. Lands that had been devoted to grain-raising have of late years been planted to fruits and vines. Turkeys and chickens are raised in great numbers, and on some farms poultry-raising is made a specialty. The turkeys average about 14 cents per pound dressed, and the chickens $4.50 a dozen. Eggs average 18 cents per dozen. There are several dairies of from ten to seventy-five cows each, and the butter and cheese made is a source of profitable income. One cheese factory markets a considerable product. Land is purchasable at from $15 to $50 per acre.

DISTRICT SOUTH OF THE AMERICAN RIVER.

The land along the American in the vicinity of Brighton and Mayhews, and above, is in some respects unlike that bordering the Sacramento. It rises gradually from the river. That nearest the stream is termed the first bottom, then comes the second bench, and finally the land running into the plains. The bottom lands are a rich alluvial, from ten to sixteen feet deep. This section produces everything in the way of deciduous fruits, grapes, nuts, cereals, and vegetables. It is one of the great areas for grapes in the State, and is particularly noted for the production of Tokays and Cornichons as table varieties. Large quantities of all varieties of wine grapes are also grown.

It was in this section that the late Senator Joseph Routier propagated the first French or petite prunes in California. They grew to perfection, and are superior to the imported, for when marketed they are fresh.

The grapes are grown on the second bench of the bottom land, which contains more clayey substance than the bottom land proper, on which, as a rule, grapes do not thrive as well.

Fruit and hops are raised on the bottom lands in profuse quantities. All kinds of vegetables are produced, but not for distant marketing. Watermelons and cantaloupes of superior quality are grown on the second bench lands.

Hon. R. D. Stephens and A. B. Humphrey, the largest producers in the district, ship their own produce and largely that of their neighbors. In 1901 they shipped over seventy carloads of table grapes and thirty of tree fruits to the Eastern markets, principally to New York. During the season about another hundred carloads were shipped to the same destination from the balance of the American River districts by the fruit-handling companies.

In the Eastern markets the American River grapes stand at the head of any produced in the State, and readily command a higher average price. It is *the* Tokay district in California. There are some growers who receive an average of $2 per crate of twenty pounds for table grapes, being 10 cents a pound gross. That realizes to the producer a return of $1.25 per crate over freight and commissions. The wine grapes are disposed of to the wineries. The production in 1901 was between seven and eight hundred tons, and they were sold at an average of $17.50 per ton.

This district is extensively and advantageously irrigated by private plants from wells and from the river. Wells are sunk from 110 to 140 feet in depth, and the water naturally rises to within about 20 feet of the surface in inexhaustible quantities. Mr. Stephens uses for irrigation of his lands a sixty horsepower steam engine, and two electric motors—one of one hundred horsepower and the other of ten. Mr. Humphrey employs for the same purpose two electric motors of fifty and twenty horsepower, respectively. Other land-owners use gasoline engines of five horsepower and upward.

The price at which land can be purchased is from $100 to $500 per acre, and, it may be added, there is very little for sale. It must, however, be understood that these prices apply to lands on which orchards and vineyards are in bearing. Other lands, similar in quality, but undeveloped, can be purchased at a very much less figure.

The Sacramento & Placerville Railroad passes handily by, and the market is, it may be said, at the very door.

The development of this section in the last ten years has simply been phenomenal; it has been largely due to the progressiveness and business capabilities of the growers. The brands on their boxes are known and recognized by the buyers in the East as a guarantee of the excellence of the contents.

FOLSOM AND VICINITY.

The section around this town was originally devoted to mining, and these operations are yet carried on extensively. Fruit and grapes were planted at an early day, and the gravelly soil of the lower foothills was found splendidly adapted to their culture. The Natoma vineyard is one of the oldest in Northern California and one of the largest in the world. It is owned by the Natoma Vineyard Company, successor of the Natoma Water and Mining Company that was organized in

1851, and it is the largest owner of water rights in the county. Its main canal, constructed in the year named, takes water from the south fork of the American River in El Dorado County. This canal is sixteen miles long. For many years the water was used for mining purposes, but in recent years has been mainly employed to irrigate the lands of the company and adjacent lands. The table grapes—some forty carloads—produced at the Natoma vineyard in 1901 were shipped East, and the wine grapes were sold to the wineries in Napa County. Other smaller vineyards produce large quantities of both table and wine grapes, and the owner of one of them operates his own winery. Bartlett pears, oranges, plums, peaches, prunes, apricots, nectarines, etc., are also extensively produced. In 1901 this section shipped to Eastern markets about two hundred carloads of fruit and grapes. A $4,000 fruit packing-house, recently built, did a profitable business the past season. In the Folsom section about 2,000 acres, aside from the Natoma vineyard, are in fruit and vines, and a large portion of the land is irrigated by the North Fork ditch. Land suited for fruit and grapes is sold at about $50 an acre. The first orange tree at Folsom was planted in 1864.

In the past year mining has again come into prominence. Two immense dredgers are operating in the banks of the American River, one at Sailor's Bar and the other at Mississippi Bar, and two others are in process of construction. A bank claim, developed in the last few months, has proven remarkably rich, and when the mines in prospect are opened up on land now bonded, about three hundred men will be employed in their development and operation.

ORANGEVALE.

With a view of demonstrating the possibilities of successful colonization, as well as the adaptability of the soil of Sacramento County to the production of all varieties of tree fruits and vines, a number of prominent business men of Sacramento in 1887 formed a corporation styled the Orangevale Colonization Company. It contemplated, on the part of the projectors, a patriotic endeavor to invite and call the attention of homeseekers to the advantages of settling in this section, rather than financial gain by the sale of lands. Three thousand acres of land were purchased, lying northeast of the City of Sacramento, and about two miles west from the town of Folsom.

The property acquired was cleared of its umbrageous oak trees, surveyed and divided into blocks of eighty acres, which were subdivided into tracts of ten acres each, all sales being thus based on multiples of ten acres. Broad avenues or roadways of a uniform width of sixty feet were provided, and traversed the property running north and south, east and west, bordered with palm, cypress, walnut, and olive trees for ornament and shade.

An irrigation system was inaugurated, the exhaustless water-supply for which was drawn from the American River, being carried and distributed throughout the colony in large iron pipes (laid in the streets and avenues) under a gravity pressure of about seventy pounds—the primitive and unsanitary method of distributing water for irrigation in open ditches being thus overcome and avoided.

Three hundred thousand dollars was expended in this enterprise, in acquiring the property, subdividing, planting, and providing an unparalleled system of irrigation under pressure sufficient to throw a stream from an ordinary hydrant and hose over the roof of any two-story building in the colony and to admit of irrigating a tract in the most perfect manner from standpipes.

A number of tracts were planted, in advance of sale, to citrus as well as deciduous fruits and vines, and it is doubtful if in any other section can be seen such a variety of fruits growing side by side in the same soil, including oranges, lemons, grape-fruit, apricots, apples, cherries, peaches, pears, plums, almonds, chestnuts, walnuts, and olives. Also several varieties of wine and table grapes, including the famous Flame Tokay, the results from which, during the season of 1901, in prices realized, led those sold from any other section of the State. There are fully fifty thousand orange trees planted.

Orangevale, as the pioneer colony of Northern and Central California, is a bright and shining example of what may be accomplished in this direction, and is peopled by an intelligent and thrifty class of citizens, who, it may be safe to say, would not have located in and become taxpayers of this county but for the foresight of the founders of this colony.

Orangevale now boasts of two public school buildings, a handsome church edifice, a postoffice, and an independent election precinct. It has a population of about three hundred, and is an important factor in the shipment of green fruits, having marketed about forty carloads of these during the past season, about one fourth of which were of the citrus varieties. Its output of marketable fruits will rapidly increase as its planted tracts come into bearing.

Admirably and beautifully situated as it is, in the first range of foothills, on the high bluffs overlooking the American River, affording it superior advantages in the matter of drainage, proximity to rail communication for the transportation of its products, and contiguity to the city as a marketing place, Orangevale is destined to become one of the most successful colonies of the State.

FAIR OAKS.

This beautiful suburb of Sacramento is situated on the bluffs of the American River, about 16 miles from the capitol, and is reached directly by the Sacramento & Placerville Railroad. There are few places in Northern California which combine, to such an extent, productive soil and picturesque scenery. It is the ideal home of the orange and the olive, and its many oak-clad knolls and commanding bluffs furnish some of the most attractive home-sites in the State. The town is about six years old, and the population, consisting largely of Eastern people, numbers at present about six hundred.

Over twelve hundred acres are planted to oranges, olives, and deciduous fruits. There are about seven hundred acres of oranges. Some of the trees, being now five years old, have borne quite heavily for the past two years. Olives have proved a great success in Fair Oaks, nearly a hundred tons having been gathered from the young orchards this year, from which a very high grade of oil has been extracted. The fruit association in Fair Oaks has erected a fine packing-house and oil-press, and the indications are that the coming year will witness large shipments of fruit from the place.

During the past year a fine steel bridge, costing over $20,000, has been built across the American River, connecting the Fair Oaks station with the town center; a fine business block, containing four stores and a commodious hall, has been erected on San Juan plaza; and along the bluffs and in other parts of the town a large number of new residences have been built, costing all the way from $2,000 to $12,000.

One of the interesting features of Fair Oaks is the so-called Chicago Fair Oaks Association, comprising some fifteen or twenty of the leading business men of Chicago, who have orange tracts in Fair Oaks; and many of whom have already built fine homes and are living in the place. These gentlemen have done much for the welfare of the town, and undoubtedly, when they all are settled there, and others have come to join them, Fair Oaks will be entitled to be called what so many now call it, the "Pasadena of Northern California," a place of beautiful homes.

Fair Oaks is already taking its place among the famous citrus-growing districts of Sacramento County. The soil is rich and abundantly watered by an extensive pipe-system connected with the North Fork ditch, which draws its unfailing supply from the American River. It has no freezes, droughts, or troublesome fruit pests. Like Auburn, Newcastle, and Orangevale, it is situated in the warm belt of the foothills, and in the district of the famous Flame Tokay grape.

The educational privileges of Fair Oaks can hardly be matched in any town of the same size in the State. The "Four Gables" is an academy of a high order, including preparatory work for college, and a very successful business department, and the town has just issued bonds for the erection of a $7,000 public school building on one of the beautiful knolls of the townsite. There is at present one flourishing church, comprising several denominations, but conducted under Methodist leadership.

Fair Oaks is somewhat of an anomaly among California towns, inasmuch as no land-owner in the place can use his property or allow it to be used for the manufacture or sale of intoxicating drinks. It is the aim of the citizens to build up a stable moral community, such as can hardly fail to attract to its borders many of the best people of the East, who have boys and girls to rear and educate.

We have already referred to the picturesque features of Fair Oaks. In this respect it stands almost alone in Sacramento County, or at least that part of it within easy reach of the capital. The county as a whole is more noted for its productiveness than for its picturesqueness, and comparatively little attention has been paid to the development of these æsthetic features which attract so many people of means to Southern California. Now it happens that Sacramento has within sight of the electric corona on the capitol a tract of some six or seven thousand acres which commands some of the finest scenery on the Pacific Slope, and which offers splendid opportunities for landscape gardening and the building of beautiful homes. As an attractive suburb, Fair Oaks is an invaluable adjunct to Sacramento; and her own citizens, as well as Eastern homeseekers, are beginning to appreciate it as such.

ALONG THE SACRAMENTO RIVER.

From Sacramento City to and beyond Isleton the frontage of the Sacramento River is an almost continuous line of orchards. The road is on the top of the levee, and the views are magnificent, over a stretch of country of amazing fertility. The land-owners are wealthy, and their residences are among the most luxurious in the county—the majority of them with furnishings costing from $5,000 to $50,000 each.

The fruit is shipped from the levee in front of the orchards, each land-owner having his shed at the water's edge, where the fruit is packed and loaded on the steamboats. In addition to the easy access to market, there is the advantage that the fruits ripen earlier than in most of the other districts in the State, and hence command high prices. Steamboat-loads of fruit (peaches, plums, Tragedy prunes, cherries, Bartlett pears, apricots, nectarines, oranges, lemons, etc.), besides beans, potatoes, and vegetables of all kinds, are carried down the river to the San Francisco market. Blackberries and strawberries are extensively cultivated.

There are several extensive dairies and stock farms along the river, which ship large quantities of butter and cheese to Sacramento and San Francisco.

Many fields of alfalfa yield five crops of hay a year at an average of six tons per acre, and six months of the year the land is used for pasturage.

Barley is extensively raised on the tule lands, where the yield is from eighty to one hundred bushels to the acre in places, but thirty sacks is the average. The barley is sown in February, and after it has been harvested the land is planted to late potatoes and beans.

The islands produce the same character of fruits, which are marketed in like manner. On the interior lands, beans and potatoes are produced in fabulous quantities. Crops are grown at all times of the year. When one is harvested, another of a different character is planted.

FLORIN DISTRICT.

The town of Florin is on the line of the Western Pacific Railroad, 9⅓ miles south of Sacramento City, and the surrounding district is the most productive strawberry belt in the State. Its product has a reputation for excellence all over the Eastern States.

The land in this section is principally a red soil, with a bedrock foundation, the soil ranging from two to three feet in depth. The depth to water averages about twelve feet, and the flow is abundant, though at places, to obtain a stronger current, the boring is made fifty or sixty feet to a stratum of quicksand, from which the water rises to about ten feet of the surface. The water is lifted mostly by windmills, though many use steam engines with oil fuel. A windmill will irrigate six acres of vineyard, but strawberries require more water. The iron mills have from 8 to 12 foot wheels, and operate a six or eight-inch pump. The cost of a mill and pump is about $120.

The principal products are strawberries and Tokay grapes. The berries are marketed in California, Oregon, Washington, British Columbia, Montana, Utah, Colorado, and Nevada.

The growers have organized a local company—the Florin Fruit

Growers' Association—and through it handle their own fruits. It is composed of some one hundred and twenty growers.

There are now planted about six hundred acres in strawberries, with about four hundred in full bearing. In the season of 1901 there were shipped 80,000 cases of fifteen pounds each that realized an average of $1 a case after paying freight and commissions. The profit is about 60 cents a case after paying for picking and casing.

Most of the Tokay grapes are shipped to Eastern markets through the local association. From three to four hundred acres are planted in grapes. In 1901 ninety carloads were sent out that brought from $800 to $1,000 each, after paying freight, commissions, and refrigerating charges.

The holdings are in small tracts—from ten to forty acres each. Land is held at from $30 to $75 an acre.

ELK GROVE DISTRICT.

Elk Grove is 15 miles south of Sacramento, on the line of the Western Pacific Railroad. It lies 5 miles east of the Sacramento River and 3 miles west of the Cosumnes. The surrounding district, including the town, has a population of about one thousand.

There are three distinct characters of soil: the red land, with the hardpan at a depth of from fourteen inches to three feet; the sediment deposit along the Cosumnes; and the adobe to the west and southwest of the town.

The principal products are grain, fruit, and poultry. Wheat, barley, and oats are quite extensively raised. A great variety, both of deciduous and citrus fruits, is grown, although no very extensive orchards have yet been planted. All varieties of grapes do well, but the Tokay is produced to perfection. One vineyard of seven acres netted $1,200 in 1901.

The dairy business is not important for its magnitude at present, but it is important as indicating a change from the old dependence on grain-raising. Some time last summer E. E. Trueblood installed a hand-power separator, and began separating on a small scale, sending the cream to the Stockton creamery. Later he secured a larger machine and ran it by steam. A few months since the business passed into the hands of Mr. Owens, who has found it necessary to get a still larger machine and make other improvements which convenience and an increased amount of work demand. From a few hundred pounds at first, the station is now skimming between thirty and forty centals of milk daily. The disbursements among the patrons for February were more than $460. The creamery men inform us that the milk from this station is the highest testing milk they receive. Probably this is due to the fact that many Jersey and high-grade cows are used here. One herd of thoroughbreds has more than once reached a composite test of 6 per cent butter-fat by the Babcock. There is every indication that this business will grow. Some small herds have returned $9 a month per cow, besides the skim milk.

A short distance east of Elk Grove there is a prosperous creamery that was in operation before the skimming station was installed in the town. M. Colton is the proprietor, and the product of this creamery is popularly known in Sacramento.

The poultry business has greatly increased in the last few years. As high as eighty cases (thirty dozen each) of eggs have been shipped in a day. About $1 per hen is the net average income for the season. The chickens are healthy, and require but little care. No great outlay is necessary. Turkeys, geese, and ducks also form a considerable industry, and bring good returns.

There is an unlimited supply of water for irrigation, at a depth of from twenty-five to fifty feet, and it is raised by windmills and engines.

Land is held at from $15 to $50 an acre. With a capital of $2,000, twenty acres of land can be purchased, buildings erected, and improvements made, where an industrious man can make a comfortable living and provide a pleasant home.

GALT DISTRICT.

The location and surroundings of Galt are ideal, and the district affords available homes for two thousand new families. It is widely known, because of the richness and variety of soils in a section embracing some 100,000 acres of land lying between two magnificent watercourses: the Cosumnes River on the north, and Dry Creek on the south.

As a wheat-producing district, the Galt section is unsurpassed by any other equal area in the Sacramento Valley. Wheat-growing has been one of the great sources of the wealth of the district, and twenty years ago prices were high, cultivation easy, the yield enormous, and fortunes quickly accumulated. Wheat at once became the staple product, and the people paid little attention to the development of other industries. Changed conditions have reduced the margin of profit in the wheat industry to an uncertain and unreliable quantity. The rich lands in the district can be used more profitably in diversified farming, but as radical changes are made slowly, wheat is liable to remain the leading product for many years to come. Grain-growers have been much wedded to that industry, and as a result in recent years they have suffered for it. But in these days of progress there is a growing tendency toward a greater diversification of farming. Many of the largest wheat-growers are going into the livestock business, and several fine herds of thoroughbred cattle are now owned in the district. Dairying is being given an impetus, and several creameries are thriving.

While the fruit industry has been in a measure neglected, still many fine orchards of deciduous fruits are scattered throughout the district. Some of the choicest oranges grown in Northern California are raised in this section, and they mature four weeks earlier than in the citrus belt of Southern California. A superior lemon is also produced. The rich bottom lands are particularly adapted to the olive. In fact, all varieties of fruit can be profitably produced. The fruit industry may be said to be in its infancy and has not received the attention its importance deserves.

During the past year the grape industry has been a fruitful source of revenue. The prices for all varieties have been good. There has been an extraordinary demand for wine grapes, and the prices ranged from $18 to $22.50 per ton. In an ordinary season the yield of wine grapes is from six to eight tons to the acre, and in a good season it often runs up to as high as ten tons. Table grapes, principally Tokays, for Eastern shipment, are successfully grown, and the producers receive as high as $40 per ton. The outlook for the grape industry is most promising, and while the acreage was increased several hundred in 1901, it now looks as if the plantings will be doubled this season.

The large landholders are subdividing their tracts into small farms, and are offering them for sale to intending settlers on advantageous terms. Many families from the Eastern States and the Northwest have located in the neighborhood within the past six months, and not a few are arriving daily. They are buying homes and will engage in grape-growing.

The inducements that are being offered to settlers are unparalleled. A proposition that meets with popular favor is being made by some of the large landholders, viz: that people of modest means who will plant, cultivate, and care for twenty, forty, sixty, or eighty acres of grapes until the vines are matured, will be given a deed, without further cost, to one half the acreage of land thus planted. In other words, the party is given the opportunity to acquire the land without having to pay a cent in cash for it. Of course, such opportunities will necessarily be limited, and no doubt in a brief time all such offers will be taken up. The soil has been demonstrated to be specially adapted to the grape, and the market is readily at hand.

The land in the district is level, and the soil, generally speaking, a heavy red clay of an average depth of from two and a half to eight feet. An inexhaustible subterranean current of water underlies the district at a depth of from fifteen to twenty-five feet. Irrigation is not required for the successful cultivation of fruit trees or vines; in fact, grapes of all varieties do better in the district without irrigation. To raise strawberries irrigation is necessary, but an abundance of water is to be had by pumping from a depth of less than twenty-five feet.

The eastern portion of the district is comprised of rolling lands, with a deep gravelly soil, red in color, and particularly adapted to wine-grape culture. The western portion affords some of the best pasture land in the valley—a deep loamy soil, very fertile, and capable of producing anything that grows under the sun. On the southern slopes can be seen some of the finest alfalfa fields in the county. Large quantities of beans, potatoes, corn, and garden truck are profitably raised on the bottom lands.

Land in large or small quantities can be bought at from $40 to $60 an acre, according to quality and location.

The amount of grain shipped from Galt and other points in the district in 1901 was about 300,000 sacks, valued at $375,000.

The shipments of table grapes to the East were ten carloads. It is impossible to give an estimate of the quantity of grapes that were sold to the local wineries, but it was large.

Hogs are extensively and profitably raised, and sheep production is an important industry. It is one of the most extensive poultry-raising districts in the county. On some of the chicken ranches as many as 5,000 are raised in a season, and the business is profitable.

The Galt Vineyard and Wine Company has already planted 285 acres of wine grapes on a single tract, and intend to continue planting from year to year until the vineyard shall consist of 1,000 acres.

Whitaker & Ray, large landholders in the district, have induced, in the past few months, twenty families to establish homes, and the newcomers are planting 600 acres of grapes. These families simply form the nucleus for a large community of people who will be attracted to the district because of the advantageous opportunities that are presented to homeseekers.

FRANKLIN DISTRICT.

Franklin is fifteen miles southeast of Sacramento City and four miles east of the Sacramento River. The soil is the ordinary plains upland, partly adobe. Wheat, oats, and barley are the principal products. In 1901 between 100,000 and 120,000 sacks of wheat were grown, and from 50,000 to 75,000 sacks of barley and oats. The grain is shipped to Port Costa from Gammon's Landing on the river, where there is a warehouse capable of storing 20,000 tons of grain. Most of the product is handled by Frank Kunsting, the principal merchant of Franklin.

There are in the district two large creameries and two skimming stations, as well as several minor skimmeries. The cream is disposed of at the two creameries spoken of. There are several dairies of from twenty to one hundred cows each, and many smaller.

Cattle-raising is a prominent industry, and about 1,000 beeves were marketed last year. At Franklin there are three cattle-dealers who furnish dressed beef to the Sacramento City market, as well as mutton and other meats. Many of the farms maintain from fifty to one hundred head of sheep.

Wine grapes are raised to some extent, and the acreage is increasing. Land can be purchased at from $20 to $30 per acre.

COSUMNES RIVER DISTRICT.

The Cosumnes River bottom is about one mile wide and twenty miles long. Then, on each side, come the uplands. The uplands are of a red gravelly soil, and with ordinary management produce about fourteen bushels of oats, twelve of barley, or ten of wheat per acre, while three fourths of a ton of oat hay per acre is a fair average. It grows all kinds of small fruits, such as blackberries, strawberries, raspberries, etc., besides all kinds and varieties of table and wine grapes. This land is held at from $7 to $20 an acre, according to the character of the improvements. Potatoes of the best quality are also produced, and much land is devoted to sheep-raising and dairying. The bottom land is a rich, dark, sandy loam, suitable for the production of almost anything that will grow in the State. Wheat, oats, and barley average about forty bushels to the acre, and Indian corn about the same. A large area is planted to fruit, and its adaptability for that purpose is unexcelled. Apricots, pears, peaches, plums, apples, quinces, pomegranates, nectarines, and all kinds of grapes do excellently. The French prune is more extensively planted than any other one variety. Oranges and lemons do well, but as yet have not been extensively grown. All kinds of vegetables are produced, while hops are in places made a specialty. The mangel-wurzel and sugar-beet do well. Alfalfa is very generally raised for hay and for fall grazing. Poultry is an important specialty, principally for the eggs. Some blooded swine are produced, and much attention is given to sheep. The dairying interest is attracting much attention, and large quantities of butter and cheese are made, particularly the latter. This bottom land is held at from $35 to $75 per acre.

SAN BENITO COUNTY.

San Benito County lies 25 miles inland and to the east of the town of Monterey; it is bounded on the north by Santa Clara County, on the east by Merced and Fresno, and on the south and west by Monterey County. The county is about 70 miles in length, averages about 21 miles in width, and embraces an area of 1,056 square miles, or 675,840 acres.

It is inclosed on two sides by mountains—on the east by the Mount Diablo range, and on the west by the Gabilan Mountains. From these ranges the surface slopes to the valley of the San Benito River, which flows northwesterly through the middle of the county, and empties into the Pajaro River. A few small streams, the most important of which is Tres Pinos Creek, are tributary to the San Benito. A very large part of the area of San Benito is classed as mountainous, but there are numbers of little valleys and much level land in the county.

SOILS.

The soil of San Benito may properly be divided into four classes, as follows:

First—About 25,000 acres of rich garden land: The soil is of a black sandy loam, and will produce in abundance any kind of vegetation, and is excellent for fruit. Upon this fertile land are raised the fine vegetables which supply local demands, and largely the markets of San Francisco.

Second—About 34,300 acres of first-class grain land, contained principally in what is known as San Benito Valley (the extreme southern portion of Santa Clara Valley). The soil is a black sandy loam, or adobe, with a blue or sandy subsoil, and holds moisture well. It is principally from this land that the large amount of grain usually shipped from this county is raised.

Third—About 46,000 acres of what is termed second-class grain land, situated in the foothills, and composed about equally of adobe and sandy soil. This land is not so strong as the valley land, but produces quite fairly, and in dry seasons is surer of good crops than the richer bottom land. From this land is cut very fine hay, noted in San Francisco markets as "Hollister hay."

Fourth—In addition to 105,300 acres capable of producing vegetables and grain, there is a large amount of hill land which makes very fine pasture. More or less of it is connected with many of the ranches in the valley.

The largest single body of valley land lies in the northern part of the county, and forms the *southern* end of the Santa Clara Valley. Numerous valleys of smaller extent add their quota to the area of first-class land. Among these may be named the San Juan, Santa Ana, Quien Sabe, Los Muertos, Bear, Panoche, and Bitter Water valleys.

CLIMATE.

San Benito County, situated midway between the San Joaquin Valley and the coast, has a climate tempered by both, avoiding the extreme heat of the former and the chilling winds of the latter. It is separated from the coast by the Gabilan range, but is yet near enough to the ocean to feel its tempering influence. Fogs are not of frequent occurrence, and during the summer months the ocean breeze finds its way every day through a mountain gap, rendering the climate very healthful and pleasant. The average temperature at Hollister shows 59.5° for the year, the highest being 109° and the lowest 21°. Vegetables grow the year round, and the nights are always cool. The average precipitation is nearly 12 inches annually, which, it may be said, all falls between November and April.

WATER-SUPPLY.

The rivers and streams that flow from the mountains bordering the county, together with numerous springs, furnish an abundant supply of water. No irrigating canals on a large scale have been constructed, because they have not been found necessary; the generous rains of the winter and spring months, in most seasons, give to the ground all the moisture needed. San Benito's topography is such that if any system were adopted for husbanding the water which runs off in the San Benito River and the Tres Pinos Creek a great portion of the valley lands could be irrigated at a small expense. There is a large area of the county in which artesian water is obtainable. In the San Felipe district alone there are a large number of artesian wells constantly flowing.

CULTURAL PRODUCTS.

San Benito has been principally devoted to farming and stock-raising, but of late years a great deal of attention has been given to horticulture, and with the most encouraging results. Large areas of land have been planted to fruit in the country around and tributary to Hollister.

One of the oldest orchards in the State is found in San Benito, being the old Mission orchard at San Juan. This was planted as early as 1785, and comprised pears, apples, olives, and grapes. Although it has been neglected and fallen largely into decay, there are still a number of the original trees standing; these are pears and olives, scattered about in promiscuous disorder.

While not strictly a fruit county, prunes, apricots, peaches, pears, apples, grapes, cherries, figs, olives, almonds, and walnuts do well.

The agricultural resources of the county are large and varied. Cereals of all descriptions are raised. Last season the hay crop alone amounted to 40,000 tons.

Vegetables of most descriptions thrive, and farmers are now paying more attention to diversified farming than heretofore. Sugar-beets and beans are grown on a large scale, and many acres of new land are now coming under cultivation.

DAIRYING AND LIVESTOCK-RAISING.

Dairying is a profitable industry, and is largely on the increase. One of the foremost modern creameries of the State is located at Hollister, the product of which is of the highest order, and in competition at the creamery contests at the State Fair and elsewhere has always been well to the front.

Poultry-raising is also a very valuable and rapidly growing industry.

Horses, cattle, and hogs are raised in the county on quite a large scale.

MINERAL RESOURCES.

The mineral resources of the county are confined mostly to the production of oil and quicksilver. The New Idria Quicksilver Company is one of the largest producers of that mineral in the State.

The population of the county is about 7,000. Hollister is the county seat, and is a growing town, with a population of over 3,000. San Juan, Tres Pinos, and other smaller towns are located in the county.

The latest report of the United States General Land Office gives the acreage of unoccupied land as over 360,000, mostly mountainous and grazing.

SAN BERNARDINO COUNTY.

San Bernardino County is not only the largest in the State of California, but it is the largest county in the United States. Its area is 20,160 square miles, or 12,902,400 acres. To the ordinary mind the figures representing the size of this county do not appeal, as they are too large for comprehension; but some idea may be gained when we say that this county is larger than the States of New Hampshire, Vermont, and Rhode Island combined; it is larger than New Jersey, Delaware, Massachusetts, and Rhode Island combined; it is very nearly as large as Massachusetts, Connecticut, and New Jersey combined. There are eight States in the Union each of which in area is less than this county.

This county is situated in the southeastern part of the State, there being but two counties between it and the Mexican line. On the north we have the State of Nevada and the large county of Inyo; on the east we have the Colorado River and the Territory of Arizona; on the south, Riverside County; and the adjoining counties on the west are Orange, Los Angeles, and Kern.

The greater portion of this vast county is what is denominated "desert." In the north is the great Mojave Desert; and in the east, the northern end of the great Colorado Desert; the only arable portions being confined to the southwestern part of the county. This arable portion of the county is called the San Bernardino Valley, sometimes the upper Santa Ana Valley. With the exception of a strip along the northern border of the great San Bernardino range of mountains, this valley, and the outlying valleys on the flanks of the mountains, are the only portions which are under cultivation. The San Bernardino Valley forms an almost perfect amphitheater encircled by mountains and hills, which amphitheater is open only on the west, allowing the sea breeze from the Pacific Ocean to sweep its entire length.

TOPOGRAPHY.

Viewed from a topographical standpoint, this county may be considered an elevated plateau or plain, traversed in different directions by ranges of mountains, separated by low, broad passes, which give the stranger the impression that it is not a range of mountains, but isolated peaks, or masses of peaks, which have a general northwest and southeast trend. Strictly speaking, there is not what is usually called a foothill region, as the mountains rise from the level of the plain to their topmost peaks in one general elevation.

The lowest part of this plain is about 900 feet above sea-level. From this elevation, the mountain range at the north of the San Bernardino Valley rises to a height of from 4,000 to 6,000 feet, culminating at the eastern end in a twin-peaked mountain, the lower and more conical elevation being called Mount San Bernardino, with an elevation of

11,800 feet, and the taller, Mount San Gorgonio, with an elevation of 12,600 feet. Mount San Gorgonio possesses the unique distinction of being the highest mountain in the world which rises in an unbroken mass from below the sea-level to its topmost pinnacle.

In the north and northeast portions of the county are many isolated peaks, which evidently, at no distant geological period, were active volcanoes, as in many places the lava flow can be traced for miles.

The mountains to the north and east, to the dweller in the valley below, seem as though they were destitute of vegetation. The mountain ranges and peaks, to an elevation of 11,000 feet, are covered with forests of pine, cedar, and juniper, but only on the top and north, the south sides being bare of everything except chaparral, sage, mesquit, and other brush.

Mount San Gorgonio is snow-capped during the entire year, and from this source is derived much of the water that is used for irrigation in the summer season in the valley below, the remainder coming from the mountain range, giving a bountiful supply of water for the use of irrigators. The melting snows of winter, being held back in the heavy growth of chaparral and brush along the mountain sides, sink deep into the soil, thence percolate slowly through permeable strata far below the surface of the earth, furnishing the supply of water from which the hundreds of artesian wells in the valley pour forth their nourishing floods. The combined waters of the streams, springs, and wells make this valley one of the best watered in all Southern California.

The forests on the mountain ranges furnish a considerable portion of the supply of lumber and timber used in the valley, and also a large supply of fuel.

Mount San Bernardino, from its apparently perfect cone, has been taken by the United States surveyors as the initial point for the land survey of all Southern California, both base and meridian starting from its peak.

The northern and eastern parts of the county are, for the most part, absolutely sterile, and no amount of water will ever bring these lands under the plow, as the soil is composed largely of sand, in many places covered with a lava flow; in other places, vast stretches of alkali; while soda, borax, and nitrates are so abundant as to create an inflorescence, whose glitter is visible from every point of view for many miles. Yet, along the northern slope of these mountains there are many stretches of fertile land, and small valleys which can be cultivated with profit wherever water is available. Along the Mojave River where it debouches from the mountains to the desert, and for many miles, the land on both sides is fertile, easily worked, and produces abundantly as long as the water-supply is available.

WATER-SUPPLY.

On the south side of the mountains the water-supply, were it properly conserved and economically used, is amply sufficient for the cultivation of all the land which is tillable and can be reached by ditches or pipe-lines. From every cañon in the range—and there are scores of them—creeks and rivers find their way to the plain below. As is the case with most streams in mountainous countries, the larger part of these creeks are torrential in their character; that is, during the rainy season and after heavy rains, they flow roaring, raging torrents, but in a few hours, or days, become dry until the next rainfall. Some, however, are perennial streams, and furnish the greater supply of water for the irrigation of the valley, and nourish and fructify the orchards, the products of which have made this valley famous over the United States. Chief among these perennial streams are the Santa Ana River, Mill Creek, Warm Creek, City Creek, Twin Creek, Lytle Creek, and San Antonio Creek. The only perennial stream on the north side of the mountains in the county is the Mojave River.

SOIL.

The soil of the San Bernardino Valley varies greatly with every locality. In the eastern part of the valley, at Redlands and Highland, it is a sharp gravel or sand, with a large mixture of alluvial deposits brought down from the mountains by the wash and torrents of countless ages. This soil is very easily worked, and with a sufficiency of water is extremely fertile. In some places clay deposits are found, but these also can be worked when proper care is exercised, as they are not of a cement-like character. The soil is heavily impregnated with iron, and is rich in potash and other necessary constituents of luxuriant plant life.

West of Redlands, at Old San Bernardino, the soil changes to a heavy, dark loam, with occasional patches of adobe. Still farther west, between Old San Bernardino and the river, the soil is of a lighter character, and possesses much more of the soda and potash constituents.

North of San Bernardino and about Rialto and Cucamonga, the soil is a light, sandy and gravelly loam. Immediately about the City of San Bernardino the soil is a strong adobe, with appearances here and there of soda salts.

About Colton and Ontario, and especially on Colton Terrace, the soil is a sharp, gravelly loam, similar to the Redlands and Highland section.

Along the river bottoms the soil is a heavy clay, and in some places a black adobe. It is cold and damp and not as suitable for fruit culture as for grazing and the growing of hay crops.

CLIMATE.

Within the borders of San Bernardino County nearly every grade, character, and variety of climate may be found. It all depends upon the elevation and the local surroundings. In the mountain valleys and upper plateaus, winter possesses almost all the features which may be found in any of the Northern or Eastern States. Snow falls, in places to a depth of from ten to twenty feet in favorable seasons, and King Frost holds sway for months at a time. Coming to a lower elevation, we find abundant rains, occasional snows, sharp frosts, and the general characteristics of a winter of the central portion of the United States. Still lower in the valleys we find frosts infrequent, snow a rarity, so much so that many children have never seen the snow fall in their lives, together with a summer temperature hovering about the 100° mark. Yet, even in the lower valleys, with this high temperature, at an elevation of from 1,000 to 2,000 feet, the constant currents of air from the snow-capped mountain peaks so modify the temperature that the nights are always pleasant, and sometimes, even in summer, too chilly for outdoor pleasures without heavy wraps.

The average annual rainfall in the lower valleys is from thirteen to fifteen inches. Except the daytime heats of summer, there are absolutely no disagreeable features to the climate, with the exception, in the winter season, of what are denominated "northers." These are north winds, with a velocity of from ten to twenty miles an hour, usually warm, extremely dry, and carrying with them a large amount of ozone. Thus, this most disagreeable feature of the winter brings with it a purifying effect on the atmosphere which is highly conducive to health. These northers are never destructive in their character, neither is it necessary to plant windbreaks on the north to protect orchards, as was the common practice a couple of decades ago. These winds are disagreeable, as every one who has experienced them will testify, but they are neither destructive nor inimical to health.

In the spring months there are occasional night and early morning fogs. These drift in from the ocean and are heaviest on low ground, thinning out until at an elevation of 1,500 or 2,000 feet they are very rare; but even on low ground they seldom last longer than until seven or eight o'clock in the morning. Many horticulturists consider these ocean fogs as of great benefit to their orchards and fields. No disagreeable land fogs are ever experienced here.

The summers may, without any degree of exaggeration, be called hot. The range of the thermometer during the day, from ten o'clock to three, will run from 90° to 105° in the San Bernardino Valley. Across the mountains, on the desert, one can have any degree of heat desired, up to 130°. The degree of sensible heat is not nearly so high as the figures on the thermometer would seem to indicate. This arises from the fact that the atmosphere is extremely dry, the hygrometer showing as low, occasionally, as eight degrees of moisture; the average humidity is not more than one third that of the Eastern States. From this low humidity, the discomforts and inconveniences incident in the East to a similar temperature are utterly unknown here. Even during the hottest days it is cool in the shade where a free circulation of air can be maintained, as under a tree out doors. Sunstrokes, heat sickness, hydrophobia, and other concomitants of an Eastern 100° temperature are here entirely unknown.

Nights in summer are always cool and pleasant, this being due to the descending currents of air from the snow-capped mountains, which form what is called by seamen the land breeze. The high temperature is also modified in summer by the sea breeze from the Pacific Ocean. This usually commences at nine or ten o'clock in the morning, and continues until within an hour of sunset.

RAINFALL.

The rainfall of the county varies a great deal, as does the climate. As one comes from the lower levels to the high altitudes the rainfall increases. The general rainfall in the lower portions of the valley will average about 13 inches. On the mountain slopes it will run from 15 to 20 inches. On the mountain ranges and peaks it will run from 40 to even as high as 60 inches. This rainfall is for the valley and south slope of the mountains, and falls between October and May. Showers between May and October are extremely rare. The heaviest rainfall in later years is in February and March.

On the north and east of the mountain ranges, on the great Mojave and Colorado deserts, the larger portion of the rainfall comes in July and August, they having no rains during the winter months. There is no data by which the amount of this rainfall may be given. The rains are very short, sharp, and heavy, frequently accompanied by thunder and lightning, which latter is almost an unknown quantity south of the mountains.

IRRIGATION WORKS.

In the number and character of her irrigation enterprises, San Bernardino County stands in the very front rank. This county has been called, with truth, the "Mother of Irrigation," because here was dug the first irrigation ditch within the limits of the State, and here were the first crops raised by means of irrigation. It is nearly a hundred years since the Mission fathers of San Gabriel established an outlying post, or sub-mission, just west of Redlands, and employed Indian labor to dig what is commonly known as the zanja. This ancient ditch is still in use and within the same banks that were first thrown up by Indian labor almost a century ago.

In 1851, when the party which had been sent to California by Brigham Young, the head of the Mormon church, to search out a site for an outfitting station for the great wagon trains which were to haul supplies from the Pacific Ocean to Salt Lake City, they selected what is now the city of San Bernardino as the location for the future settlement. No sooner had they arrived here with their families and household goods than they set about constructing the first irrigation system in the valley. Taking the waters of several mountain streams from their beds, under a crude and wasteful system, they yet demonstrated that the use of water for irrigation purposes not only produced bountiful crops, but that irrigation was an absolute insurance against the disasters of dry seasons.

From this beginning, fifty years ago, the network of irrigation canals and pipe-lines and flumes and ditches has spread over the larger portion of the arable part of the valley, even, in some cases, extending well up the mountain slopes. As a result, there are to-day hundreds of miles of canals and pipe-lines, with thousands of miles of laterals and individual pipe-lines. In addition to this, hundreds and hundreds of wells have been bored in the valley, each producing a flowing stream of water without other or further expense, which volume is sufficient not only to irrigate many thousand of acres in this valley, but also furnishes the magnificent supply of water which fructifies and renders fertile the great plain on which the city of Riverside stands.

The largest of these irrigation systems is that of the Bear Valley Irrigation Company. This system commences with an artificial lake high up in the mountains, where the waters are held back by a solid masonry dam which has been thrown across Bear Creek cañon. In this artificial lake, when full, is stored 10,000,000,000 gallons, or 26,465 acre-feet, of water. The water from this lake travels for miles in a natural gorge made by Bear Creek and the Santa Ana River. From this, at the mouth of the Santa Ana River, it is diverted into cement ditches and pipe-lines, and through them distributed for use.

Another gigantic irrigation system is that which was projected by the Arrowhead Reservoir Company eight years ago, and upon which work has been steadily progressing. This company is now confident that within two years it will be able to furnish an abundant supply of water for many thousand acres of land in the western part of the valley.

This water-supply, coming from the high Sierras, and derived from melting snows, is exceptional in its purity and freedom from any deleterious substances. Almost all the towns in the valley are supplied with this pure water by means of subsidiary reservoirs and pipe-lines and artesian wells, which secure the absolute purity of their domestic water-supply, which purity and abundance are the admiration and envy of less fortunate towns.

In the last four years there have been three years of serious drought. The mountain supply from the reservoirs was exhausted; the streams ran low, or became streaks of sand and bowlders, and a water famine seemed imminent. But the energy and enterprise of the people averted all danger, and what seemed at first to threaten a serious calamity has proven, although costly, a blessing in disguise, for it has developed a new source of water which will prove an insurance against any number of dry years. Wells have been bored in every section of the valley, in many of which an artesian flow was developed; and where flowing water was not found, pumping plants have been installed, which have added thousands of inches of irrigation water to the available supply, not only in this but in the adjoining county of Riverside. There is now no fear of any serious damage to horticulture or agriculture by reason of a failure of rain, for this underground water-supply seems to be inexhaustible, leading one to believe that its primary source lies far beyond the region of the mountain ranges of this county. Many hundreds of thousands of dollars have been expended in this subterranean exploration for water during the past four years, and the result amply justifies the expenditure.

FRUITS.

Almost every variety of fruit known to man is or can be produced in some part of this county. The only exceptions are those which are strictly tropical in character. In the mountain valleys and upon the upper plateaus, apples and cherries are grown in as great perfection as can be found anywhere, and their cultivation, in their proper localities, has proven very remunerative.

On the lower levels, all of the deciduous fruits are produced, the principal varieties grown being peaches, apricots, prunes, and grapes. The production of citrus fruits—oranges, lemons, and pomeloes—is very large, these fruits being grown to a perfection seldom reached elsewhere. It is more than forty years since the first orange trees were planted in this valley, although the production of citrus fruits on a commercial scale dates back only about twenty years. The production of oranges has increased rapidly during the last six years, the shipments from the county for the calendar year 1901 reaching 177,335,535 pounds.

The first planting of orange trees in the county were two trees set out by Hon. Anson Van Leuven in his dooryard in Old San Bernardino in the early sixties, and by M. H. Crafts at what is now called Crafton, at about the same time or a year or two later. The planting of orange trees for the purpose of raising fruit on a commercial basis dates back practically less than twenty years.

The chief fruit-growing sections of San Bernardino County are, in the order of their importance, Redlands, Ontario, Highland, Colton, and Rialto. The leading fruits of the county are those of the citrus family, the oranges from this county having taken the highest rank wherever introduced in the United States. Almost one third of the oranges shipped from the State of California are produced in this county.

Some of the finest apple orchards in the State are just coming into bearing.

In the western part of the county, in the Rialto, Etiwanda, and Cucamonga neighborhoods, there is produced a large quantity of raisins, which rank equal in quality and appearance with the best produced anywhere. The shipments during the year 1901 amounted to 1,345,325 pounds. Another section of the county especially adapted to the culture of grapes is that about Hesperia, which lies along the Mojave River.

The number of fruit trees in the county, as returned by the Assessor for the year 1901, is given as follows:

	Bearing.	Non-Bearing.
Apple	10,000	3,500
Apricot	60,000	3,000
Cherry	8,000	3,000
Fig	3,000	1,500
Olive	20,000	15,000
Peach	75,000	4,000
Pear	5,000	1,000
Prune	20,000	10,000
Lemon	120,000	40,000
Orange	750,000	600,000
Almond	2,000	1,500
Walnut	3,000	1,000

Add to this in grapevines, 7,000 acres of raisin grapes in bearing and 2,000 acres non-bearing, and 2,500 acres of bearing wine grapes and 3,000 acres non-bearing.

SUGAR.

In the southwest corner of the valley is located the Chino Ranch, on which is the third largest beet-sugar factory in the world. The acreage devoted to sugar-beet culture is in the neighborhood of 20,000. The factory has a capacity for the production of about 12,000 tons of refined sugar annually. The lands of the Chino Ranch seem peculiarly adapted to the raising of sugar-beets, producing roots of an exceptional sugar content and of a very high degree of purity. The culture of sugar-beets has been a profitable industry for the farmers engaged therein. On this ranch are fattened thousands of head of cattle upon the beet pulp, which is siloed for that purpose.

MARMALADE.

A marmalade factory has been started in Redlands, which has a capacity of 300 gallons per day.

HONEY.

Along the slope of the mountains, in the mountain valleys and cañons are numerous bee ranches, or apiaries, from which are produced a large amount of honey, which commands a high price in the Eastern markets. This county ranks second in the State in the production of honey.

EXPORTS.

The following table will show, for the year 1901, the shipments of the products of the soil:

	Pounds.
Oranges and lemons	177,335,535
Vegetables	21,954,540
Dried fruits	3,815,411
Canned fruits	2,544,825
Raisins	1,345,325
Green fruits (deciduous)	709,375
Wines and brandies	414,800
Nuts	20,600

LIVESTOCK, DAIRYING, AND AGRICULTURE.

The raising of cattle and sheep is carried on along the mountain ranges and in the upper mountain valleys, and on the Chino Ranch several thousand head of beef cattle are fattened annually. Several large bands of sheep are grazed on the ranges, and the annual wool clip is about 300,000 pounds.

Dairying is carried on in both the upper and lower valleys, the principal dairies and creameries being in the Cajon Pass, Yucaipe, Victoria, Chino, and a section about the city of San Bernardino. The production of butter from the principal dairies and creameries for the year 1901 was 184,728 pounds, and a much larger one for the future is assured. Pure-bred or grades of high-class dairy cattle are in general use throughout the county.

A stock company has been formed for the breeding of the most desirable classes of horses, and has purchased a large ranch at Victor for a farm to be devoted exclusively to the raising of horses.

Wheat, oats, and barley are grown in considerable quantities, and alfalfa is grown with profit.

Vegetables of nearly all descriptions are raised, the yield being very large, and a growing shipping trade to outside markets has been established.

MINES AND MINING.

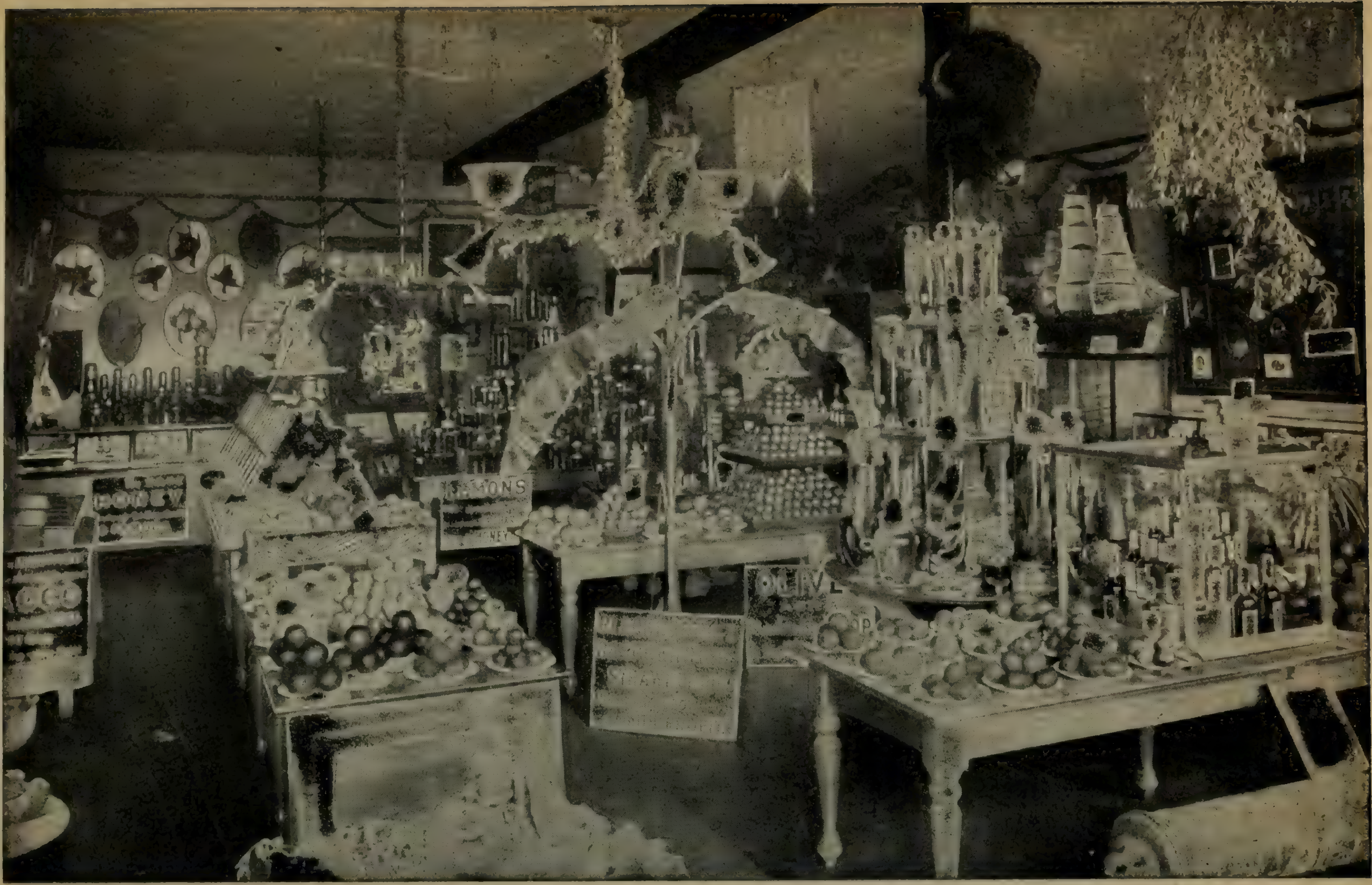
The northern and eastern portions of the county are very heavily mineralized, and although prospecting has been carried on for the last fifty years, new and greater finds are being made every year. Almost every known mineral has been discovered in some portion of the county. Gold, silver, copper, iron, tin, lead, borax, soda, and nitrates are found in abundance and scattered over a wide area of country. Some of the richest silver mines in the State are to be found in this county. Copper exists in great abundance, and recent developments have shown some of the copper properties to be of extraordinary richness. The high cost of freight to and from the mines, the scarcity of water, which renders the life of the prospector precarious as well as interfering with the working of the mines, the scarcity and high cost of fuel—these things all combined have limited prospecting and greatly retarded mining development. The building of railroads across the desert has partially removed some of these obstacles, and mining has been prosecuted with more vigor during the past year than for almost any year in the last twenty. New mines are being opened, new mills are being built, new finds are being made, and the outlook for the mining industry is very bright indeed.

The mineral production of this county for the year 1901 is valued at $1,844,239. From the report of the State Mineralogist for the year 1901 we take the following figures:

Gold	$399,693
Silver	$57,164
Copper	50,000 lbs.
Lead	500 lbs.
Borax	16,796 tons.
Turquoise	$20,000
Cement	71,800 bbls.
Granite	3,840 cu. ft.
Lime	38,783 bbls.
Limestone	54,210 tons.
Macadam	5,500 tons.
Rubble	297,695 tons.
Paving-blocks	180,000

At Declezville, a few miles west of Colton, immense quarries are being operated, supplying rock for the Government breakwater at San Pedro Harbor.

Although these figures in regard to mining do not directly pertain to agriculture or horticulture, yet they are of value, because of the fact that the entire mining region must draw its supplies of vegetables and fruits from the nearby valleys. As there are thousands of men engaged in mining in the county, so there are thousands of consumers for the products of the farmer and fruit-grower in the arable portion of the county.



MAIN EXHIBITION ROOM—SAN DIEGO CHAMBER OF COMMERCE.

SAN DIEGO COUNTY.

By H. P. WOOD,

Secretary Chamber of Commerce, San Diego, California.

San Diego County occupies the southern part of the State of California, and has an area of nearly 8,500 square miles, being slightly larger than Massachusetts. On the north the county is bounded by Orange and Riverside counties; on the east by the Colorado River, which here divides Arizona from California; on the south by the republic of Mexico; while on the west, the Pacific Ocean washes its shores for upward of 75 miles. The land rises gently from the ocean for a distance of about 50 miles to a chain of peaks forming the backbone of the county, descending again quite rapidly to the Colorado River valley, the greater part of which is below sea-level.

ARABLE LAND.

The arable portion of the western slope of the county is divided into a series of irregular terraces or plateaus.

The lower or coast terrace comprises the Tia Juana, Otay, Sweetwater, Mission, Soledad, San Dieguito, Agua Hedionda, San Luis Rey, and Santa Margarita or Los Flores valleys, with the intervening mesas. This large acreage is practically frostless. Next comes the Jamul, Jamacha, Dehesa, El Cajon, Poway, Bernardo, San Pasqual, Escondido, San Marcos, and Vista valleys, varying in elevation from 400 to 500 feet.

The third terrace, whose altitude ranges from 1,000 to 2,500 feet, comprises the foothill region, consisting of Dulzura, Lyons, Lawson, Alpine, Viejas, Barona, San Vicente, Santa Maria, Ballena, Bear, Moosa, Monserrate, and Fallbrook, with numerous smaller intervening valleys, nooks, and glens.

Next comes the mountain region, which includes Potrero, Campo, Moreno, Pine Valley, Descanso, Green Valley, Cuyamaca, San Felipe, Santa Ysabel, Warners, Mesa Grande, Oak Grove, and Palomar.

The area of tillable land in these valleys and mesas is approximately 600,000 acres, a still much larger area being suited to pasture and grazing. The elevation of the mountain valleys varies from 2,500 to 4,500 feet. They are now chiefly devoted to stock-raising, but in time with the improvement of transportation facilities many of them will be found well adapted to the growing of small fruits and vegetables and to diversified farming.

SOILS.

The arable soils of San Diego County may be classed under two heads: granitic and adobe; though there is very often a mixture of both, resembling adobe. The granitic soils are formed by the disintegration of the soft red (iron-stained) or gray granite, which forms most of the country rock, and contains an abundance of vegetable matter. The adobe is mainly clay, and will probably stand a larger cropping without fertilization or rotation than any other soil, but is not as easily worked as the granitic soil.

COLORADO RIVER VALLEY.

To the east of the mountains, in the valley of the Colorado, is another principality, which until quite recently has been lying dormant, but now water is being brought from the Colorado River and fully 500,000 acres of the richest and most productive land on the face of the globe is being rapidly taken up by intending settlers, and these broad acres will soon add their products of alfalfa, sugar-beets, sorghum, hogs, cattle, dairy products, etc., to the output of San Diego County. Many miles of canals and laterals have already been built, construction is being pushed, and although the enterprise was only fairly commenced some three years since, water is being delivered to several thousand acres, and crops of sorghum and millet have already been harvested, thereby proving the fertility of the soil. While there are sections of land here and there containing more or less alkali, the soil of this valley, which for the greater part is below sea-level, is the silt washed down by the Colorado River during countless ages, is rich in plant food, and can be depended upon for profitable returns. Plans are being perfected for the planting of several thousand acres to alfalfa, and it is expected that the raising of cattle and hogs will be undertaken on a large scale.

The towns of Ranchita, Imperial, Paringa, Silsbee, and Calexico have already sprung into existence. Imperial boasts a general merchandise store, lumber yard, hotel, bank, church, and printing office, and is now connected with the main line of the Southern Pacific Railway by a branch running south from Old Beach Station.

INTERMOUNTAIN REGION.

The intermountain region is by no means valueless, being rich in minerals. Good oil indications have recently been found, and a number of wells are being bored at this writing.

The general height of the divide above sea-level is about 5,000 feet, with several lower gaps or passes, also a number of higher elevations. The following table gives the elevation of some of the principal points:

	Feet.
Smith, or Palomar, Mountain	6,200
San Felipe Pass	3,725
Temecula	3,200
Volcan Mountain	6,000
Julian	4,300
Cuyamaca Peak	6,500
Descanso	3,500
Pine Valley	3,800
Laguna	5,675
Campo	2,700
Mount Tecarte	3,750
Lyons Peak	3,400
San Miguel	2,850
Cajon Peak	3,200

CLIMATE.

The climate of San Diego County is unique. Gen. A. W. Greely, Chief U. S. Signal Service, is authority for the statement that the forty square miles in which the City of San Diego is situated has the most equable climate known to any mainland.

The following table, prepared by Ford A. Carpenter, U. S. Weather Bureau, giving the climatic data of San Diego, during the months of January and July, for a period of thirty years, is both interesting and instructive:

	Jan.	July.
TEMPERATURE—		
Average or normal	55°	67°
Average daily range	17°	12°
Mean of warmest (mean maximum)	69°	76°
Mean of coldest (mean minimum)	43°	59°
Highest or maximum	80°	88°
Lowest or minimum	32°	54°
HUMIDITY—		
Average relative	72	78
PRECIPITATION—		
Average, in inches	1.94	.01
WIND—		
Prevailing direction	N.W.	N.W.
Average hourly velocity, in miles per hour	5	6
WEATHER—		
Clear days—Average number	15	11
Largest number	25	30
Smallest number	6	2
Partly cloudy days—Average number	10	16
Largest number	15	28
Smallest number	4	1
Cloudy days—Average number	6	4
Largest number	22	17
Smallest number	1	0
Rainy days—Average number	6	Less than 1
Largest number	11	3
Smallest number	1	0

The winds from the Colorado delta on the east and the never-failing sea breezes fanning the western boundary of the county, together with a humidity that is as constant as the temperature is equable, combine to produce a perfect climate.

RAINFALL.

The following table gives the rainfall in the City of San Diego from January 1st to December 31st, for a period of thirty years:

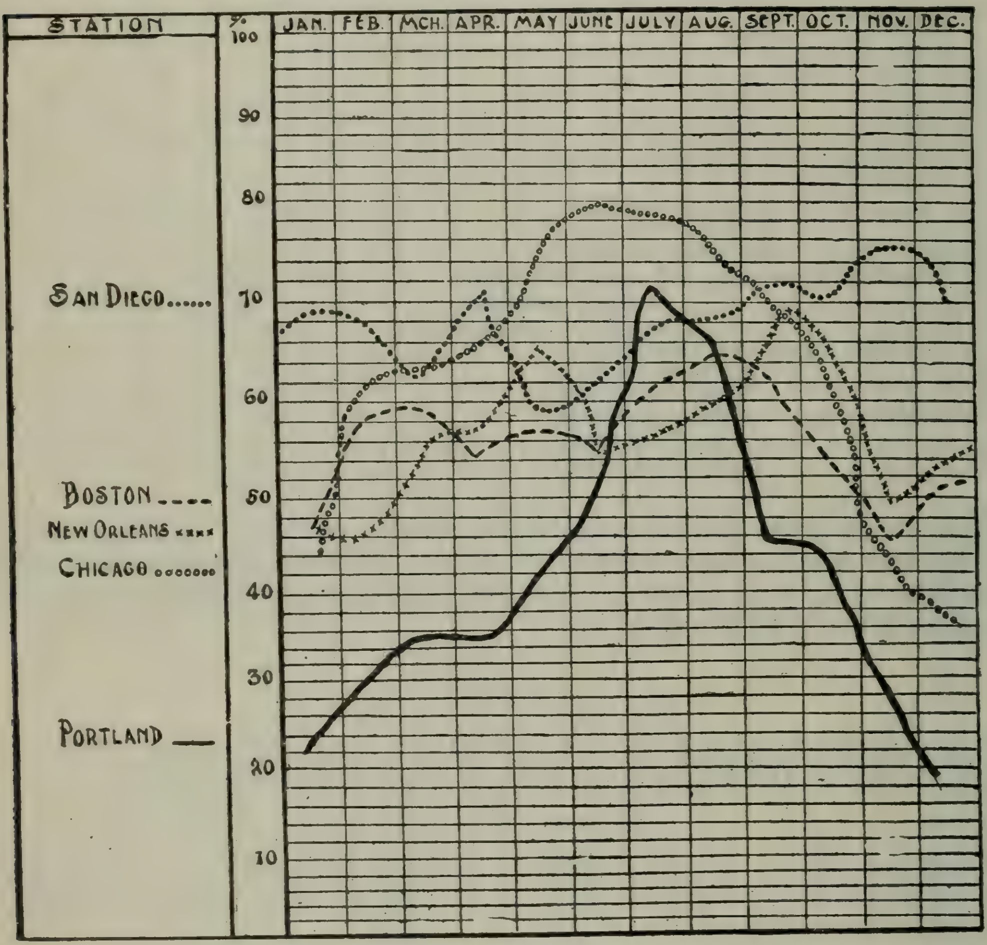
Year.	Annual Rainfall. Inches.
1872	6.04
1873	13.01
1874	10.91
1875	6.80
1876	7.24
1877	8.12
1878	13.87
1879	14.71
1880	10.37
1881	5.00
1882	9.74
1883	8.01
1884	27.59
1885	5.73
1886	15.35
1887	10.45
1888	11.57
1889	16.03
1890	8.02
1891	8.99
1892	9.09
1893	10.29
1894	4.35
1895	11.33
1896	8.83
1897	8.93
1898	4.67
1899	6.08
1900	5.77
1901	10.45

The rainfall increases and greater extremes of temperature occur as you leave the coast, the higher mountain peaks being often covered with snow to quite a depth during a part of the winter season. Such a climate can not but be healthy, and as the truth of the foregoing statements is getting to be more generally known, each succeeding year sees a greater number of people seeking out this wonderfully attractive "Home Land."

SUNSHINE.

The following chart not only shows the average monthly percentage of sunshine, but also indicates in a striking manner the fact that San Diego has its minimum of sunshine during the summer season, an all-sufficient reason for the remarkably cool and pleasant summers for which the place is noted:

Average Monthly Percentage of Sunshine.



POPULATION.

The population of San Diego County, according to the last census, is 35,090, of which more than half, or 17,700, reside in the city of San Diego.

CITIES AND TOWNS.

San Diego.—The modern city of San Diego was founded by A. E. Horton, Esq., in 1867. The situation is not only sanitary and attractive, with its hills and slopes following the curves of the beautiful bay so well protected by Point Loma, but it is also admirably adapted for the ocean commerce that is now seeking entrance through the Silver Gate. Numerous wharves extend into deep water, and in their neighborhood may be found lumber yards, planing mills, warehouses, foundries, etc.; then comes the retail business blocks, many of them very handsome structures; and beyond these, spreading out over the undulating hill land, is the residence portion of the city, hundreds of charming homes filling up block after block. The electric street railway system is equipped with modern cars and is complete in every respect. Water is provided in abundance, the supply and distribution being controlled by the municipality. The sewerage system was wisely planned and is ample for a population of one hundred thousand. The streets of the city are well lighted by electricity. San Diego's schools, private and public, have an excellent reputation. An attractive public library, made possible by the generosity of Andrew Carnegie, Esq., supplemented by the liberality of the citizens of San Diego, has just been completed. Besides several weekly papers, the city supports three excellent dailies—one morning and two evening. A large and handsome opera-house, perfect in its appointments, is on the circuit of the very best theatrical and operatic companies. The different religious organizations worship in attractive edifices; secret societies and benevolent associations have their lodge rooms; and numerous musical and literary clubs are supported by an active membership of ladies and gentlemen. The Country Club, a prosperous institution, maintains extensive and well-kept golf grounds. There are several strong banking institutions in the city, and a large number of excellent retail stores, where the variety, quality, and price in all lines of goods will satisfy the most economical and particular. The housekeeper will always find the markets well supplied with meats, game, fish, vegetables, and fruit. The hotel accommodations of the city are excellent, and there are a number of sunny modern lodging-houses, where rooms may be obtained at reasonable rates, while the restaurants of the city are noted for their cheapness and excellence. Houses, large and small, furnished and unfurnished, may be had at reasonable rentals. For invalids and those requiring special medical and surgical care, there are, pleasantly situated within the city's limits, several sanitariums, thoroughly modern in their arrangements, with experienced physicians, and trained nurses in constant attendance.

Coronado is situated just across the bay from San Diego, with its big hotel and many other attractions. This property is mainly under the control of the Coronado Beach Company, which is bending every effort to build up a city of beautiful homes, besides making of the place the most attractive summer and winter resort on the Pacific Coast, if not in the United States. The resident population of Coronado is 935.

National City, four miles south of San Diego, has a population of 1,086, and is the center of the lemon industry of San Diego County, a large manufactory of citrus products being located at this point.

Escondido, a place of 755 inhabitants, is attractively situated in the fertile valley of the same name, and is one of the most prosperous towns in Southern California.

Oceanside, about 30 miles north of San Diego, has a population of 330. This place is on the main line of the Southern California Railway, with branches running to Escondido and Fallbrook.

Villages.—The above are the only towns whose population is given by the last census, but there are a number of other villages scattered throughout the county, where you will find churches, schools, stores, etc., the centers of an active development, generally connected by telephone with San Diego, such as Alpine, Ballena, Banner, Bernardo, Bonita, Bostonia, Campo, Carlsbad, Chula Vista, Dehesa, Del Mar, Descanso, Dulzura, El Cajon, Encinitas, Fallbrook, Foster, Hedges, Helix, Jamul, Julian, Lakeside, La Mesa, Lemon Grove, Merle, Mesa Grande, Miramar, Moosa, Nellie, Nestor, Ogilby, Olivenhain, Otay, Pala, Potrero, Poway, Ramona, Richland, San Luis Rey, San Pasqual, San Marcos, Santa Ysabel, Santee, Sorrento, South San Diego, Stowe, Sunnyside, Tia Juana, Twin Oaks, Valley Center, Vista, Warner, Witch Creek, and Wynola.

SCHOOLS.

As an evidence that education keeps pace with the population, the County Superintendent of Schools reports that there are one hundred and fifty school-houses distributed through the county, the instruction in which is up to the usual high standard found throughout California.

GOOD ROADS.

The Board of Supervisors of San Diego County have done and are doing good work in the way of road-building, the most distant and mountainous places being readily reached over excellent highways. It is a matter of surprise and favorable comment that so much has been accomplished with such a large mileage of roads to be looked after and with so small an amount of funds available for their care.

TRANSPORTATION.

From the port of San Diego, which has one of the best harbors on the Pacific Coast, transportation may be had by either rail or water, thus assuring low rates upon all classes of products, a wide range of which is made possible by the difference in elevation of the various parts of the county.

WATER DEVELOPMENT.

The progress of any locality in the southwest is largely dependent upon its water-supply, and in this line of development, San Diego County has made excellent progress, as the following table will show:

PRINCIPAL RESERVOIR SITES IN SAN DIEGO COUNTY.

Name of Reservoir.	Elevation above sea-level at base of dam.	Capacity, in million gallons.
	Feet.	
Barrett (under construction)	1,600	15,226
Cuyamaca (built)	4,650	3,718
Dye Valley	2,200	1,275
Escondido (built)	1,300	1,150
La Mesa (built)	453	2,000
Lower Otay (built)	400	21,653
Moreno (under construction)	3,100	15,226
Pine Valley	3,700	6,800
Pamo	803	16,000
San Luis Rey	2,613	62,950
Santa Maria	1,500	3,000
Sweetwater (built)	145	5,882
Upper Otay (completed to 70 feet contour)	540	1,000

Water is impounded mainly for the citrus orchards of the coast section, the higher valleys requiring but little or no irrigation for their crops of cereals, deciduous fruits, olives, vegetables, etc.

VARIETIES OF FRUIT.

Following is a list of the varieties of fruit grown in San Diego County, and the time they may be gathered:

Oranges, all the year.
Lemons, all the year.
Limes, all the year.
Figs, July to Christmas.
Apples, July to November.
Pears, July to November.
Grapes, July to December.
Peaches, June to November.
Apricots, June to September.
Plums and Prunes, June to September.
Japanese Persimmons, November and December.
Guavas, nearly all the year.
Loquats, May and June.
Strawberries, nearly all the year.
Raspberries, June to September.
Blackberries, June to November.
Currants, May and June.
Watermelons, July to December.
Mulberries, July to December.
Nectarines, August.
Olives, December and January.
Pomegranates, September to December.
Quinces, October to December.

Last year's crop of apples grown in the justly famed Julian apple belt represented from 30,000 to 50,000 boxes.

ASSESSOR'S REPORT.

In the report of the County Assessor made July 1, 1902, the following data is given:

Number of Fruit Trees Growing in the County.

	Bearing.	Non-Bearing.
Apple	20,000	20,000
Apricot	46,500	27,700
Cherry	3,000	2,500
Fig	16,000	11,500
Olive	40,000	82,500
Peach	60,000	80,000
Pear	18,000	12,500
Prune (French)	40,000	70,000
Prune (other kinds)	6,000	4,000
Lemon	170,000	250,000
Orange	75,000	45,000
Almond	5,000	14,500
Walnut	4,500	16,000
Grape-fruit	8,000	12,000
Total	532,000	648,200

Number of Acres Sown to Hay and Grain for the Crop of 1901.

	Acres.
Wheat	10,000
Oats	4,000
Barley	6,000
Corn	200
Hay	25,000
Total	45,200

Area of Grapevines Growing (All Bearing)

	Acres.
For table	275
For raisins	4,850
For wine	450
Total	5,575

LAND VALUES.

Unimproved citrus land is worth from $50 to $350 per acre with water. Improved orchards from $200 per acre up. Deciduous fruit, olive, grape, and general farming land, $5 to $50 per acre. Values are not inflated, and there are many good and safe investments for capital.

CITRUS FRUITS.

It is estimated that a carload of citrus fruit is shipped out of Southern California every five minutes during the season, a fair proportion of which comes from San Diego County.

The lemon and orange culls, which were formerly allowed to rot and sour the land, are now taken to the citrus-products factory and turned into citric acid, oil of lemon, oil of orange, extracts, etc.

OLIVE OIL—HONEY.

San Diego County olive oil received a gold medal at the last Paris Exposition. The demand for a pure olive oil is much greater than the supply, and the superiority of the California pickled olive is creating an increased demand for that product.

The county's honey crop for 1901 amounted to one hundred carloads, having a value of about $1,000 per car.

RAISINS.

The raisins grown in the Escondido and El Cajon valleys, being dried in an equable climate, entirely free from hot scorching summers, have a soft skin and are superior in that respect to those produced elsewhere in the State. This, also, may be said of other dried fruit.

SILK CULTURE—A HOME INDUSTRY.

There is every reason to believe that in the near future the cultivation of the silkworm will hold a most important place in the industrial development of San Diego County. The climatic conditions are so perfectly adapted to the delicate constitution of the worm, and the foliage of the mulberry tree may be had in such wholesome condition practically during the entire year, that instead of the industry being restricted, as elsewhere, to a season of but a few weeks' duration, it can be carried on during the entire twelve months, thus affording women and children an easy and pleasant way of assisting in providing for the family maintenance. Many acres have been set out to mulberry trees, and it may be said that while the industry is yet in its infancy, a good start has been made, with every promise of success.

DAIRYING.

The last two years, but more especially the past twelve months, have witnessed a marked development of the dairy industry throughout San Diego County, made possible largely by the installation of cream separators at different points convenient to stage and railway communication with the city of San Diego. While there are a few creameries operating outside of the city in connection with the different large ranches, by far the greatest quantity of the cream produced is shipped to San Diego and manufactured into butter by the New England Dairy and Creamery. This concern has a capacity of three thousand pounds of butter per day, and turns out an even product of high grade, which always commands the highest market price. The following described plants are now in operation, furnishing cream to the factory above mentioned:

Location.	Name.	Capacity of Plant, in Pounds of Milk per Hour.	Number of Cows.
San Luis Rey	San Luis Rey Creamery	2,500	300
San Dieguito	Gilbert & Connell	1,750	150
San Pasqual	C. L. Holliday	1,750	150
Bonsall	F. Loveland	1,750	150
Ramona	Ramona Creamery	1,000	100
Sorrento	W. G. Baker	1,000	100
Descanso	Philip Brown	600	---
Escondido	James Black	600	40
Escondido	A. H. Clancy	350	15
Escondido	J. B. Carroll	350	30
Escondido	Thomas Carroll	350	15
Escondido	Cravath & Dye	600	50
Escondido	F. W. Davis	600	50
Escondido	Robert Daly	600	30
Escondido	M. Reidy	600	75
Poway	John Frank	600	40
Poway	John Lawson	600	30
Poway	W. R. Lawson	600	30
Poway	Dan Luce	600	30
Poway	Miles Nelson	350	15
Poway	E. G. Norton	600	75
Poway	J. W. O'Connell	600	30
Poway	Don Smith	600	20
Poway	C. C. Watson	600	30
Ballena	J. C. Fergeson	350	15
Ballena	J. W. Warnock	600	30
Del Mar	William Froelich	600	30
Del Mar	A. C. Welts	600	20
Nestor	George & Son	600	50
Nestor	W. F. Springer	600	15
Nestor	H. F. Schnell	350	80
San Diego	— Guyalarmetti	600	20
Sorrento	— McGonigle	1,000	35
Olivenhain	Gautner & Wallenstein	600	35
Olivenhain	Keoebu Fernando	600	40
Olivenhain	T. W. Teten	600	20
Olivenhain	A. Wiegan	600	30
Descanso	H. R. Higgins	600	40
Almond Station	Howard & Lonsteller	600	70
Cottonwood	William Healey	350	10
Foster Station	— Keith	600	20
Santee	Mrs. McKoon	350	20
Santee	C. Rinde	350	15
Santee	J. S. Stockton	600	40
Viejas	Benton & McCain	600	30
Lakeside	W. M. Miller	350	30
Lakeside	J. W. Swanson	350	20
Campo	— Ortego	350	20
San Pasqual	E. Roberts	600	40
San Pasqual	Jagger & Preston	600	40
Lusardi	M. A. Stockwell	600	20
San Diego	— Rens	600	40
Fallbrook	J. B. Sample	600	40
Vista	J. B. Squires	350	20
Santa Ysabel	Santa Ysabel Creamery	7,500	500
Santa Ysabel	Rose Glen Creamery	1,750	200

It will be readily seen that the above described plants are not running to their full capacity; and not only is the number of cows being increased, but it is safe to assume that the remarkable success of those now engaged in the industry will result in doubling the number of separators throughout the county within the next twelve months.

The foregoing enumeration does not include the San Pasqual creamery, supplied by 150 cows; Woods & Olds' creamery, supplied by 150 cows; and Jersey Dairy Company, supplied by 200 cows.

Nor does it include the following list of dairies whose entire product of sweet milk is sold to customers throughout the city of San Diego: G. N. Gilbert's dairy, having 300 cows; G. H. Rodman's dairy, having 30 cows; Jersey Dairy, having 30 cows; Allen Bros.' dairy, having 60 cows; Renggelli's dairy, having 20 cows; and A. Matt's dairy, having 40 cows.

The farmer, even in the most isolated locality, can now take his milk to the district separator, receive cash for his cream, and have the skim-milk to take home for the hogs, thus securing a steady income.

The demand for good dairy products is continually increasing, not only for home consumption, but also to supply the Hawaiian Islands and the trans-Pacific trade. The United States Department of Agriculture is now trying experimental shipments to different parts of Central and South America, where it is probable that quite a trade can be worked up, provided our manufacturers are careful to continue supplying a first-class product.

The cow is proving to be a money-maker and a mortgage-raiser, giving value to many neglected ranches and opening up a bright and prosperous future for the farmers throughout San Diego County.

SMALL INVESTMENTS.

The question is often asked, What can a man do in San Diego County with from $2,000 to $5,000? Many instances of success may be cited where a beginning was made with very much less, and it would seem that this should be so under conditions so favorable, where the soil is so rich and productive, and where, in addition to the ordinary horticultural and agricultural pursuits, there are so many opportunities for the development of industries as yet comparatively new to the southwest, such as tobacco-raising, silk and cotton culture, the growing of flower bulbs, seeds, etc.

The cost of living is reasonable, and the price of building materials compares very favorably with other parts of the country. The opportunities for getting products to market are quite good to-day, and with the completion of a direct line of railway east from San Diego, a route for which is now being surveyed under the auspices of the San Diego Chamber of Commerce, the county will be specially favored as regards transportation.

MINING.

In addition to the horticultural and agricultural interests of the county the opportunities for investments in mining are very attractive. One of the largest producing gold mines in the State is located at Hedges, in the eastern part of the county, while the towns of Julian and Banner are almost entirely supported by the mines in their vicinity.

Besides gold, some excellent copper prospects are being developed. Silver, zinc, lead, and tin have been found, as also antimony, while the largest deposit of lepidolite known is situated near Pala, in the northern part of the county. Kaolin of good quality has been found, and considerable development is now going on for oil, which, it is thought, will be found in large quantities throughout the county. Coal prospects also exist and are receiving some attention. The following minerals are also found: Asbestos, cement, fire clay, Fuller's earth, gypsum, limestone, manganese, marble, mineral paint, mineral water, salt, mica, graphite, sulphur, and alum.

Quite recently a deposit of unusually beautiful tourmaline crystals was uncovered near Mesa Grande, from which gems valued at many thousands of dollars were taken out.

SPORT.

The sportsman reading this article will probably ask what of the shooting and fishing? Quail are abundant in the foothills, with an occasional deer to reward the hardy hunter; while the variety of fish to be caught in the bay and ocean is almost endless.

In the summing up it may be truthfully said that no part of the United States offers greater inducements to seekers after health, pleasure, or profit than does San Diego County, California, concerning the resources of which the Secretary of the San Diego Chamber of Commerce will always be pleased to forward detailed information when requested to do so.

SAN JOAQUIN COUNTY.

San Joaquin County lies at the head of the San Joaquin Valley, and is bounded by Stanislaus, Calaveras, and Amador counties on the east, Stanislaus and Santa Clara counties on the south, Alameda, Contra Costa, and Solano counties on the west, and Sacramento County on the north. The two great rivers which drain the State, the Sacramento from north to south, and the San Joaquin from south to north, form their junction near the northwest corner of this county, and pour their united waters into Suisun Bay. The San Joaquin River intersects the county, and is navigable to its southern boundary the year round. The area of this county is 1,370 square miles, or 870,000 acres, generally level valley land. In the northwest, along the rivers, is a region of tule land and marshes; through the northern part of these tule lands the San Joaquin and its tributaries flow in many channels to their junction with the Sacramento. Throughout this region are numerous islands, which are subject to overflow. They have rich soil, and such as are leveed are under cultivation. Extending northward are the sandy lands, the two sections being separated by a broad belt of black loam and adobe land. The foothill region comprises a narrow strip along the eastern boundary. The lands forming the delta comprise about one fifth of the land of the county. These had to be protected from overflow by the construction of levees before they could be brought under cultivation. About 150,000 acres are under cultivation.

The Mokelumne River, an important tributary of the San Joaquin, flows through the northern part of the county, and is navigable for a considerable distance from its intersection with the San Joaquin. The Calaveras River, a stream carrying much water in the rainy season, flows through the central portion of the county.

CLIMATE.

What has been said of the climate of other counties in the San Joaquin Valley will apply to San Joaquin County. The months of June, July, August, and September are hot, especially July and August, when the mercury will frequently pass above the hundred mark. But despite this degree of heat, it is not enervating, and except on extremely hot days, which are rare, the summer temperature is not disagreeably hot. In the winter months the mercury will sometimes drop below freezing, and harsh frosts in the early morning are not uncommon. The location of the county in the central portion of the State, and so near the only great pass through the Coast Range, by which the waters of the two great rivers of the State find their outlet to the ocean, renders the locality subject to the most favorable natural climatic influences. Heavy fogs are rare, and the chilling winds which sometimes prevail on the coast are much modified before they reach the interior.

The following table of rainfall from 1870 to 1900 will give a good idea of the annual precipitation in San Joaquin County. In July and August rainfall is so rare that it may be said never to rain in those months:

RAINFALL AT STOCKTON.

The official record for calendar years.

YEAR.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1870	.37	2.35	.99	.07	.12	.31	.00	.00	.00	.15	.67	1.35	6.38
1871	1.47	1.70	.30	.69	.40	T.	T.	.00	.00	.14	1.09	11.49	17.28
1872	2.58	3.46	1.43	.51	.06	.04	.00	.00	.00	.03	1.37	6.25	15.73
1873	.75	3.97	.47	.44	.00	.00	.03	.00	.00	.31	.76	3.94	10.67
1874	3.94	1.78	3.33	.56	.58	.00	.00	.00	.23	1.09	3.45	.23	15.19
1875	4.54	.28	.87	.00	.00	.45	.00	.00	.00	.01	5.86	2.85	14.86
1876	3.26	2.65	3.23	.40	.00	.00	.07	.00	.00	2.11	.30	.00	12.02
1877	3.23	.23	.75	.00	.32	.00	.00	.00	.00	.36	.72	1.31	7.01
1878	5.45	6.70	2.56	1.01	.65	.00	.00	.00	.00	.34	.51	.42	17.64
1879	2.28	2.94	2.06	1.75	.96	.20	.00	.00	.00	.58	2.05	1.67	14.49
1880	1.54	1.32	.89	6.28	1.01	.00	.00	.00	.00	.00	.04	7.09	18.17
1881	2.83	2.50	.82	1.11	.29	.00	.00	.00	T.	.24	.73	1.65	10.17
1882	1.27	.84	2.64	2.21	.00	.11	.00	.00	.50	1.86	1.11	.27	10.81
1883	2.55	.35	2.55	1.23	4.84	.00	.00	.00	.18	.93	.51	1.00	14.14
1884	1.94	4.43	6.66	2.94	.50	1.27	.00	.00	.19	1.40	.00	5.69	25.02
1885	1.23	.00	.26	.77	.00	.05	.00	.03	.00	.00	6.08	1.24	9.66
1886	5.36	.04	1.21	3.43	.00	.00	.00	.00	.00	.22	.84	.82	11.92
1887	.36	3.78	.21	1.57	.00	.03	.00	.00	.27	.00	.52	3.06	9.80
1888	3.36	.48	2.29	.28	.55	.00	.00	.00	.88	.00	2.70	2.42	12.96
1889	.31	.98	3.98	.14	1.52	.06	.00	.00	.00	3.39	3.27	6.17	19.82
1890	4.99	1.66	1.26	1.08	.55	.00	.00	.00	.57	.00	.00	2.31	12.42
1891	.95	3.19	1.14	1.58	.30	.05	.00	.00	.20	.05	.07	4.58	12.11
1892	.95	1.25	2.50	.81	1.44	.36	.00	T.	.08	.79	3.66	2.99	14.83
1893	2.68	2.14	2.59	.96	.00	.00	T.	.00	.13	.00	2.38	1.42	12.30
1894	3.88	4.93	.45	.10	1.84	.70	.00	.00	1.76	1.32	.56	6.80	22.34
1895	5.24	1.70	1.00	.63	.70	.00	.00	.00	.50	.26	1.09	1.20	12.39
1896	6.09	.19	1.76	2.65	.86	.00	T.	.19	T.	1.11	2.30	1.12	16.37
1897	1.81	2.85	2.78	.37	.09	T.	.00	.01	.03	1.37	.39	1.23	10.93
1898	.61	1.32	.84	T.	1.11	.03	.00	.00	.35	.88	.56	1.50	7.23
1899	3.15	.18	6.58	.53	.47	.20	.00	.05	.00	3.64	2.90	1.83	19.50
1900	2.92	.37	1.45	2.26	2.72	.00	.00	.00	.12	1.83	4.87	1.09	15.30

SOILS.

Although there is a great variety of soil, it may be confidently asserted that there is no utterly barren or unproductive lands in the whole of San Joaquin County. Even in the limited mountainous district in the southwestern portion, which is so rugged and hilly as to be incapable of profitable cultivation, the land affords a fine range for stock in seasons when the usual rainfall causes the native grasses to grow in abundance upon the steep hillsides.

The western portion of the county consists of a rich delta, bordering the San Joaquin and Mokelumne rivers, which here have channels dividing the lands into tracts, which are designated as islands. The natural growth upon this land is a species of flag, here termed tule, which rankly grows upon the overflowed ground, and appears to the traveler upon the steamers plying upon these rivers, in some seasons of the year, like immense fields of green grain. As this kind of vegetation would indicate, the land was formerly constantly subjected to overflow, and only in the later months of the drier seasons was it free from water so that stock could range upon it. It has, however, been demonstrated that this land is among the most productive and valuable in the State, and that by the expenditure of comparatively small amounts for the construction of levees to protect it from overflow, it can be made to produce a great variety of crops. Although the reclamation of these lands was at first regarded as problematical, and many mistakes and failures marked the progress of the work during its earlier inception, enough has now been accomplished to show that the work upon a large scale is wholly practicable, and the success that has attended the efforts of those who have given the subject proper attention when constructing their reclamation works, so as to effectually secure the object sought, will encourage the owners of most of this character of land to provide for bringing it under cultivation.

In some of the reclaimed districts there are orchards of peaches and pears, which are very productive, and the small fruits, such as blackberries and strawberries, are also grown there with great profit.

In the central portion of the county and surrounding Stockton there is a large area of adobe land, a black, clayey soil, from 4 to 8 feet in depth, resting upon a subsoil of marl or a clayey hardpan. While this soil is intractable and not easily worked except when in a suitable condition, or when it contains exactly the proper amount of moisture, it is remarkably fertile. This soil with irrigation and careful cultivation will produce a great variety of crops, and has been found especially adapted to the growth of choice varieties of table grapes, as well as the pear and other varieties of fruit trees. Through the portion of the county where the adobe land predominates there are, however, many varieties of soil, all of which have been proven to be equally good for the production of the cereals, but some better than the adobe for other crops. While all varieties appear to be rich in plant-food, some are more easily worked and contain different portions of sand and alluvium matter, which makes them more suitable for growth of trees and vines.

That portion of the county lying north of the Mokelumne River was originally covered with a growth of white and live oak trees, together with chaparral and other underbrush. It was not regarded with favor by the first settlers, and was not cleared and brought under cultivation for several years after farming had been carried on to a large extent in other portions of the county. It is now, however, regarded as among the most valuable land in the State.

Along the Mokelumne there is considerable bottom land, which is overflowed in seasons of extreme high water, but which can be cultivated after the water recedes. This land is extraordinarily fertile and capable of producing an almost endless variety of crops. Along the lower Mokelumne is a large extent of territory which was classed as swamp land. Much of this has been thoroughly reclaimed, and is now profitably cultivated to cereals and other crops. Staten Island contains about 3,000 acres, and a portion of this delta formed by the two channels of the Mokelumne has been reclaimed at great expense, and is now made very productive.

South of the Mokelumne, and extending from the swamp land to the foothills on the east, is a large area of very valuable land, the soil of which is a sandy loam, easily cultivated and well adapted to the growth of vines and fruit trees. The grape can be here successfully grown without irrigation.

In the eastern portion of the county, extending from the Mokelumne River south for about 12 miles, there is considerable hilly and rolling land, the soil of which is varied, but generally a red clay, and sometimes containing gravel. At present most of this land is cultivated to wheat, but it is believed by many to be choice vineyard land, as the grapevine has been profitably grown in many places.

The land bordering the Calaveras River has generally been considered among the best in the county. Its rich, alluvial soil has always produced large crops of wheat, and those who have planted trees and vines in this portion of the county have generally been successful in growing them without irrigation.

In the southeastern portion of the county there is a large area of land with sandy soil, which was originally not considered as valuable as those portions of the county where heavier, clayey soils predominate. It is a noticeable fact, however, that the farmers upon the sandy soil of the county are generally prosperous, and although their land may not produce so much per acre, they generally feel sure of a crop.

Upon the west side of the San Joaquin River in this county there is a body of land from 8 to 10 miles in width and extending for 25 miles, which in favorable seasons has produced extraordinary crops of wheat. The soil is a deep, sandy loam, in many places from 30 to 40 feet to the hardpan, and with a supply of water it could be made the most productive and valuable land in the county. This large body of land is an important portion of San Joaquin County, and must eventually be furnished with means of artificial irrigation from the San Joaquin River, which in seasons when irrigation is necessary to secure the growth of vegetation pours its torrents of water past the land to the sea.

IRRIGATION.

The Mokelumne in the northern, the Calaveras in the central, and the Stanislaus forming part of the southern boundary of the county, are all important streams, and can be used for irrigation; but irrigation is not generally practiced, except for alfalfa, as other crops can be produced without recourse to it. Two irrigation districts have been formed, and one, known as the Mokelumne Ditch and Irrigating Company, is in operation irrigating land near Lodi. This company was organized in 1876, with a capital stock of $100,000, for the purpose of taking water from the Mokelumne River for irrigation, manufacturing, and mining purposes. The capital stock has since been increased to $300,000. The company has built a dam 32 feet high and 277 feet long, and the line of the main canal has been surveyed from the dam to Bear Creek, a natural channel, which will be used in its distributing system. The main canal is 30 feet wide on the bottom, 42 feet at water-surface, and will carry 6 feet of water. The grade of the canal is sufficient to give it a capacity of 598 cubic feet per second. The amount of land lying under the company's main canal adapted to irrigation purposes is about 120,000 acres. It is the intention of the company to furnish water for manufacturing purposes.

A company with a capital stock of $500,000 has secured the rights on the Stanislaus River, and the work is progressing rapidly. By this ditch the southern and eastern portions of the county will be irrigated.

The Mokelumne Land and Water Company has already expended $50,000 on a stone dam which is built across the Mokelumne River. This will turn a stream of water through a ditch 20 feet wide on the bottom and 50 feet on the top, over the northern and central portions of the county.

The Weller Ditch Company will furnish the central portion with a never-failing supply of water.

The farmers in the southeastern part of the county have taken steps to form an irrigation district under the Wright law, instead of taking water from the ditch of the Stanislaus and San Joaquin Water Company. Some time ago a meeting of the principal land-owners in the territory affected was held and it was decided to make arrangements to extend the canal from Escalon through quite a section of property to Ripon. This canal will probably be built the coming year.

Within a very short time San Joaquin will have the best irrigating system in the United States.

FRUITS AND NUTS.

Experiments have been made to test the capabilities of the soil and climate of San Joaquin County for the production of a large variety of fruits, and while it has been demonstrated that in locations where the conditions are favorable almost every kind of fruit tree produced in the temperate and semi-tropical regions can be successfully grown, it must be admitted that particular care should be given to the selection of varieties that are adapted to the different localties. The pear, fig, and almond tree will flourish with proper cultivation in almost all portions of the county, and in many localities without artificial irrigation. The pear tree, if given proper attention, has been proven to be very productive and orchards have yielded a large profit to their fortunate owners. Even upon the heavier and more intractable soils it does well, and seems to be but slightly affected by the summer drought after the tree is well rooted, as it seems to draw sufficient moisture from the subsoil to secure for itself a healthy growth, and also to enable it to produce a crop of fruit. In the vicinity of Stockton, and upon land that is not regarded as the best for the growth of trees, there are trees that have regularly produced fine crops of pears, which have not been artificially irrigated for many years.

The fig tree also seems to be especially adapted to this soil and climate, and is as tenacious of life as the oak trees which were growing upon this land when it was settled upon by Americans. The black California fig was very generally planted by the early settlers, and there are now many trees scattered throughout the State which have neither been cultivated nor irrigated for years, and yet they annually produce crops of figs, and seem to be little if any affected by the dry seasons which are so destructive to many other kinds of trees. It has also been found that other varieties of figs, which are so highly prized in other countries, and from which the fig of commerce is produced, can be successfully grown in this county, and that the imported varieties are as hardy and as well adapted to this climate as are those varieties which have been so long cultivated as to be almost natives of this State, and like them, produce two crops each season.

The almond is another tree which has been found peculiarly well adapted to the locality, and can be profitably grown throughout the larger portion of the county. Trees which have arrived at the age when a full crop can be expected are now proving profitable to their owners, and almond orchards will eventually be among the productive industries of the county.

Walnut trees, including the black, English, and French, also do well upon most of the land in this county, and although on account of their slow growth they have not been generally cultivated, they are now beginning to be looked upon with great favor, and many are being planted each year.

The peach, apricot, and nectarine are grown successfully throughout the county, but most profitably upon the bottom lands and soils that are naturally moist.

The prune has been found to do well here, and more trees of that variety are being annually planted. The quince also flourishes, and is very productive in all portions of the county.

The small fruits, such as blackberries, raspberries, strawberries, etc., are grown throughout the county, and are particularly productive upon the reclaimed lands and the botton lands adjacent to the rivers. These fruits can be raised throughout the county upon any land that can be irrigated, and large quantities are produced to supply the home market, and also for shipment to San Francisco.

The larger part of San Joaquin County is adapted to fruit culture, but the principal sections now devoted to orchards are found along the Mokelumne and San Joaquin rivers, at Lodi, Stockton, and the numerous islands formed by the San Joaquin. This county is adapted to a very wide range of fruits, chief among which are apricots, peaches, prunes, almonds, with some apples, pears, plums, olives, and figs. A very large quantity of berries of all kinds is grown in the island district. These fruits are principally shipped to Chicago, although a large amount of the second-class fruit finds its way to the canneries of Stockton, San Francisco, and Sacramento. Besides the fruit shipped green, a large amount is annually dried, which is disposed of to San Francisco and Eastern jobbers. In packing for the Eastern market, peaches are packed in 20-pound boxes, pears in 40-pound boxes, and prunes in boxes and crates. The regulation packages are, peach boxes, 24 by 12 by 4½ inches, holding two tiers and weighing 20 pounds. These cost 5 cents each to the grower. Pear boxes are of the same dimensions, but are 9 inches deep, and cost 9 cents.

The shipment of green fruit from San Joaquin County in 1891 was 650 tons; but as the orchards were generally young, this quantity has been greatly increased from year to year until it is estimated that fully 10,000 tons were shipped in 1901.

There has been a great deal of planting done in many sections of the county the past year, principally apricots, almonds, olives, pears, peaches, and grapes. Grapes especially are receiving much attention. In the vicinity of Lodi, ex-Senator Langford is planting 240 acres; Ing Bros., 90; Keen Bros., 80; J. C. Thompson, 80; or a total of 480 acres in that section alone. Besides these there will be many other smaller vineyards planted.

ACREAGE AND VARIETY OF FRUIT IN SAN JOAQUIN COUNTY.

Acres of Grapevines growing:	Bearing.	Non-Bearing.	Total.
For table	960	1,550	2,510
For raisins	280	390	670
For wine	870	1,217	2,087

Number of Fruit Trees growing:	Bearing.	Non-Bearing.	Total.
Apple	1,410	975	2,385
Apricot	81,483	17,600	99,083
Cherry	4,006	3,720	7,726
Fig	6,010	1,240	7,250
Olive	19,790	5,092	24,882
Peach	75,621	18,211	93,832
Pear	15,826	3,940	19,760
Prune (French)	45,209	18,700	63,909
Prune (other kinds)	13,740	12,600	26,340
Lemon	446	275	721
Orange	1,228	1,540	2,768
Almond	126,757	40,312	167,069
Walnut	720	570	1,290

GRAIN AND HAY.

As this is a great grain section, many acres are every year sown to the principal grains. In 1901 there was planted the following acreage:

	Acres.
Wheat	550,927
Oats	2,340
Barley	235,750
Corn	600
Rye	19,000
Hay	3,895

VEGETABLES AND SEEDS.

The raising of asparagus is rapidly becoming one of the chief industries. The land in the western part of the county is particularly well suited to the growing of this vegetable and hundreds of acres are now being put in. Two large canneries handle the product, two will be built this spring, and a third will be put up later in the season. The Hickmott Asparagus Company has 3,000 acres under cultivation and last year shipped 150,000 cases of canned goods.

Celery is to be planted this year on a large scale. Five hundred acres will be put in by one person, who estimates that the land will yield 1,200 bunches (twelve heads to a bunch) to the acre. Los Angeles capitalists who have recently purchased a large tract of this peat land will also have a large acreage of celery.

The Cox Seed Company of San Francisco has rented 500 acres for the propagation of miscellaneous seeds, regarding it as the best location for that purpose in California. The company changed its operations from another county, where it has for several years engaged in seed-raising, for the following reasons: Cheaper land, capacity to produce one third more, with one quarter less cost of cultivation, and 60 per cent less transportation.

DAIRYING—LIVESTOCK.

Dairying is also coming to the front. Numerous skimming stations are scattered over the county, and where four years ago there was not a single creamery, four large ones are now doing a profitable business.

The raising of mules has been found to be another profitable undertaking and many farmers have engaged in it. This year 4,000 were shipped from this county, billed for the Philippines, Sandwich Islands, Kansas, and South Africa.

On the whole, San Joaquin County has the prospects of a very bright and prosperous future, and as investors are rapidly taking advantage of the low price of land, it is expected that the county will soon be settled with the large population it so richly deserves.

SAN LUIS OBISPO COUNTY.

San Luis Obispo County is bounded along its entire western side by the Pacific Ocean, on the north it is bounded by Monterey, on the east by Kern, and on the south by Santa Barbara County. Its area embraces 3,578 square miles, or 2,289,920 acres, and extends from the summit of the Coast Range on the east to the ocean on the west.

The county is traversed by a low range of mountains running northwest to southeast, dividing the county into two unequal parts, one third being on the coast and two thirds being in the interior. The elevation and trend of this range adapt it to catch all the rains of winter, giving it and the subjacent country an abundance of water. Springs are numerous from base to summit, and many streams run perennially through deep valleys down either slope. The largest of these streams on the western slope are the San Simeon, Santa Rosa, Villa, Old Creek, Mono, Chorro, San Luis, Pismo, Arroyo Grande, Suez, Huesna, Alamo, and Cuyama.

From the northeastern slope of this range flows the Salinas with its many branches, the San Juan from the far east, Santa Margarita, Atascadero, Paso Robles, San Marcos, Nacimiento, the latter receiving the Las Tablas, flowing northerly between the Santa Lucia and the range called the San José by the United States Geological Survey.

The valleys of San Luis Obispo County are many and fertile. West of Santa Lucia is the coast region, a broad area of foothills and valley land, with the specially named valleys of San Simeon, Santa Rosa, Green, Villa, Old Creek, Morro, Chorro, Los Osos, Laguna, San Luis, Corral de Piedra, Arroyo Grande, Huasna, and Cuyama; and east of the dividing mountains are the great valleys of San José, or Pozo, Santa Margarita, Salinas, Huer Huero, San Juan, Carrisa, Elkhorn, Estrella, Pala Prieta, Cholame, and those of many streams. The Estrella is one of the large valleys of the east, an elevated plain bordering the Estrella River, and north of it is the similar plain of Cholame.

CLIMATE.

Along the coast frost is rarely seen—in many places never—yet grapes do not ripen well nor oranges grow successfully on the coast; but there is a distinct thermal belt, altitude 100 to 600 feet, east and north of San Luis Obispo, unknown to frost. The most delicious oranges grow in this belt. The interior valleys have a climate similar to that of the famous Salinas Valley of Monterey. The average temperature of San Luis Obispo, near the coast, varies little winter and summer, ranging from an average of 54° to an average of 62°. The interior valleys range from extremes of 32° in winter to 100° in summer, though such extremes are rare, but the average winter and average summer show much smaller differences. The average annual rainfall is 21.07 inches.

FRUITS, NUTS, AND VEGETABLES.

Much attention is now being paid to fruit culture, though the county has not yet reached a prominent rank in this respect. In the Arroyo Grande section fruits and vegetables grow in profusion and to great size. On the coast apples and pears rank best; in the interior the prune, apricot, and olive; on the hills the choicest grapes, for table, raisins, and wine, are produced. Near Templeton is a 250-acre prune orchard. Around Paso Robles much attention is now being given to fruit culture, although the orchards are yet young. Other admirable fruit sections are the Arroyo Grande Valley, the Salinas Basin, and the San José Valley. There is no limit to the possible development of this county in fruit culture, whenever enterprise pushes it and the outside markets are cheaply reached.

The total shipments of apples from the Arroyo Grande Valley the past season amounted to 45,000 boxes. Of this amount 23,000 boxes went to Los Angeles.

The production of English walnuts has just sprung into the front rank of the industries of the county. It is confined chiefly to the Corral de Piedra Valley, on the coast side of the Santa Lucia Mountains. Most of the trees are still young, but the yield was considerable last year. John H. Thompson, who planted out the first grove nine years ago, sold $3,000 worth of walnuts from a twenty-acre tract the past season.

Potatoes, beans, squash, cabbage, onions, tomatoes, and other vegetables are grown extensively and attain enormous size. Beans figure largely among the exports of the county.

The yield of beans in the Arroyo Grande Valley during the season of 1901 was the largest in the history of the county, and the harvest was not finished until late in October.

GRAIN AND HAY.

All the cereal crops are grown on the uplands. The wheat shipments along the railroad from Paso Robles, Templeton, and San Miguel are very large. The wheat of this section bears a very high reputation for fine quality and high percentage of flour.

The wheat crop in the Cholame Valley, on the Estrella Plains, in the northeastern part of the county, has not been equaled in the past fifteen years. All the warehouses are filled, and a large portion of the crop has already found its way to market. From present indications the acreage to be sown to grain for the season of 1902 will be one third larger than that of any past season. Much of the land in the eastern part of the county, which in previous years has been utilized for stock ranges, has been brought under cultivation through the encouragement of last season's fine crop.

Considerable quantities of hay, both grain and alfalfa, are raised, the crop last year being large, with the prospect that the crop for 1902 will exceed all previous ones.

STOCK-RAISING AND DAIRYING.

The character of the county makes stock-raising and dairying very profitable. Abundant natural water and vegetation and extensive ranges prevail. The higher plateaus of the southeast are covered with grasses and are devoted to stock-raising. There are many large stock ranges, and dairy farms are numerous. The annual product is over 3,500,000 pounds of butter and 900,000 pounds of cheese, most of which is shipped to San Francisco.

Poultry-raising is very successful, the fowls being able to run out all winter. Large quantities of chickens and eggs are shipped.

CITIES AND TOWNS.

The population of San Luis Obispo County is close to 17,000.

San Luis Obispo, the county seat, is located about 8 miles from the seaport of Port Harford, with which it is connected by rail. It is on the main line of the Southern Pacific Railroad, which gives it the benefit of a through coast route from San Francisco to Los Angeles.

Paso Robles is also a prosperous town, the resort of invalids and tourists, near which is located the celebrated hot sulphur and mud springs, which many invalids seek for their curative powers. The United States Experiment Station, consisting of 20 acres, is located there.

Templeton has now in operation a large sawmill. Several grain warehouses are located there.

Port Harford does a large shipping business. The coast steamers between San Francisco and Los Angeles all call there.

San Miguel, Arroyo Grande, and Santa Margarita are all thriving and steadily growing towns.

OTHER INDUSTRIES.

Off the coast considerable numbers of fish are caught. Fishing is quite an important industry, and is greatly on the increase.

Quicksilver, onyx, copper, coal, chrome iron, gold, silver, asphaltum, and petroleum are found in various parts of the county. The quicksilver mines in the Las Tablas hills are now being profitably worked and afford employment to a large number of men.

Good land all through the county can now be obtained at very reasonable prices. This county offers the most favorable opportunities to home-seekers. Lands will surely advance in price now that the Southern Pacific Railroad between San Francisco and Los Angeles, running through the entire county, is completed. Producers have also the advantage of regular lines of steamers and other vessels to carry their produce to the San Francisco and Los Angeles markets at low rates of freight.

SAN MATEO COUNTY.

San Mateo County is bounded on the north by San Francisco, on the east by the bay and Santa Clara County, on the south by Santa Cruz County, and on the west by the Pacific Ocean. The county is 5 miles wide where it adjoins the City and County of San Francisco. To the southward it rapidly widens, and attains a width of 20 miles in the center of the county, and much over that distance at its southerly line. Its length is 42 miles on a straight center line. Its area is 459 square miles, or 293,760 acres. It has a frontage of 65 miles on the ocean and 35 miles on the bay of San Francisco. Its frontage on the bay is a gradual slope from the foothills of the Santa Morena range to tidewater. This slope skirts the bay shore, and is flanked by the Santa Morena range, which separates it from the Pacific Ocean.

San Mateo County covers the larger part of the peninsula which bounds the bay of San Francisco on the southwest, being separated from the Golden Gate only by the city of San Francisco. Beyond the southern verge of the San Francisco hills the bay sweeps abruptly inland. Low headlands extend southerly in irregular indentations to the county line, where the bay curves gently inland, again forming a crescent at the foot of Visitacion Valley. South of this valley the hills rise abruptly to the summit of Mount San Bruno. The Coast Range, which runs through the west of the county, has at the southern line a width of fully 9 miles of broken and semi-detached ranges, and an average altitude of about 2,500 feet.

CLIMATE.

The topography of the county governs the climate. The Santa Cruz Mountains continue their course through San Mateo County. They trend to the northwest, and at a point 14 miles from the straits through which the waters of the Pacific Ocean flow into the bay of San Francisco, they rapidly fall in height, and seem to lose themselves in the ocean. From this point to the south side of the Golden Gate the face of the ground is broken into low, rolling hills and sand dunes of variable heights. The northwest summer trade winds, accompanied by detached drifts of fog, sweep over the depression, and give San Francisco its harsh but not unhealthful summer climate.

South of the point of the peninsula the mountains rise rapidly, attaining a height of 2,500 feet above the level of the sea. This range turns the current of the sea breeze, and holds back the fog which crawls up the slope and banks itself along the summit, as though it had become entangled in the trees and shrubs which crown the crest of the range. This mountain fog bank is the condensed freshness of the sea, out of which a cool breeze flows down the easterly slope of the range to the bay shore, cooling the atmosphere without the inconvenience of the propelling winds or actual contact with the fog. In other words, the air warmed by the morning sun rises up and checks the fog, while a cool breeze flows down the slope to replace it.

The climate is, in fact, a successful blend of the sea breeze, having a normal temperature of 55°, with the warm air of the Santa Clara Valley.

SOILS.

The soil of San Mateo is generally a warm, sandy loam, with admixture of adobe in some places. There are about 23,000 acres of salt marsh land on the bay side.

CULTURAL PRODUCTS.

The great interests of San Mateo are dairying and vegetable-growing for the San Francisco market. Orchards, up to within a few years ago, were confined practically to the "family orchard" for home use, but are now being set out, and fruit is grown for market, being found very profitable. At Pescadero some excellent apples are grown, also peaches, prunes, and some other fruits.

Berries are coming to the front as a good paying crop, and the acreage is being increased very materially. Owing to the nearness to market, and adaptability of soil and climatic conditions, berries are one of the best paying crops.

The olive has passed the experimental stage and been proven a paying product, and olive oil of local production has been on the market for some time and is considered equal to the best imported grade. An orchard of fifty acres is coming into bearing this year, and the acreage is being added to steadily. In the near future this will be one of the best producing and revenue-yielding crops in the county.

Cut flowers and potted plants yield a good revenue to those engaged in raising them. This county is now furnishing the major portion of cut flowers to the florists of San Francisco. Raising of flowers is not confined to greenhouses, but, owing to mildness of climate, they are successfully cultivated out of doors.

EXPORTS DURING 1901.

Cereals—	
Wheat	475 tons.
Oats	20,500 tons.
Barley	10,200 tons.
Hay	22,750 tons.

Dairy Produce—	
Butter	400,000 lbs.
Cheese	670,000 lbs.
Cream	2,500 gals.
Milk	2,825,000 gals.

Vegetables—	
Potatoes	3,000 tons.
Beans	1,000 tons.
Onions	100 tons.
Cauliflower	1,000 tons.
Green peas	75 tons.
Cabbage	15,000 tons.
Carrots	200 tons.
Miscellaneous (consisting of turnips, celery, table beets, green onions, lettuce, parsnips, artichokes, green beans, sprouts, etc.)	750 tons.

Fruit—	
Apples	19,500 boxes.
Pears	500 boxes.
Prunes (green)	300 boxes.
Miscellaneous	500 boxes.
Prunes (dried)	100 tons.
Strawberries	4,000 chests
Grapes (table)	5 tons.
Grapes (wine)	250 tons.
Wine	1,100,000 gals.

STOCK AND DAIRYING.

A large amount of butter and cheese is manufactured in this county for the San Francisco market, and thousands of gallons of milk are daily shipped to the city. There are a number of large dairies famous for their output, where extensive experiments have been made in the grasses best adapted to the soil and giving the best results in milk. Most of the dairying and manufacture of butter and cheese is carried on in the coast section, and the products shipped to the city by sea. Creameries are in successful operation at Pescadero and Half Moon Bay, and in other portions of the county.

Stock-raising, on the grazing lands of the mountain ranges, is another profitable industry. There is practically no export of stock raised, as the packing works at South San Francisco, in the county, buy up the county's supply and is exported as a finished product.

Considerable capital is invested in the raising of high-class light harness horses and superior carriage horses.

Poultry-raising pays. Heretofore this industry has been merely an adjunct to the general farm and orchard, but the returns have been so satisfactory that poultry ranches are being started in several places in the county, and past experience and future outlook fully warrant capital being invested in this enterprise.

TIMBER.

It is surprising to find so large a tract of virgin timber so near a large city, as exists in this county. In the extreme southwestern portion, in what is termed the Big Basin, there are estimated standing 100,000 acres of redwood of great size, rivaling, in some cases, the gigantic sequoias of the Sierra Nevada.

Oil has been discovered in paying quantities near Half Moon Bay; it is of high grade, with a paraffine base.

SANTA BARBARA COUNTY.

Santa Barbara County lies in the angle formed by the eastward trend of the California coast from Point Concepcion. Consequently, it is bounded on the south by the waters of the Santa Barbara channel, and on the west by the waters of the Pacific Ocean; on the north is the County of San Luis Obispo, and on the east is the County of Ventura. Parallel with the southern coast, and distant from 2 to 5 miles, is the rugged range of the Santa Ynez Mountains, from 3,000 to 4,000 feet in altitude. The eastern part of the county north of this range is occupied by the San Rafael Mountains, now forming one of the Government forest reserves. The western part of the county north of the Santa Ynez is broken into several valleys, separated by ranges of hills, the larger of these valleys being Santa Maria, Los Alamos, Santa Ynez, and Lompoc. That portion of the county lying south of the Santa Ynez range and along the channel is known as the Santa Barbara Valley. The channel islands of San Miguel, Santa Rosa, Santa Cruz, and Anacapa are also included in the political division of Santa Barbara County.

AVAILABLE ARABLE LAND.

Traversed by mountains, there must, of course, be waste land, but there is the following acreage available for practical uses:

	Acres.
Santa Maria Valley, with the valleys that open out of it and that pertain to it, and the slopes of the foothills that bound it	250,000
Los Alamos Valley	150,000
Lompoc Valley	230,000
Santa Ynez Valley	200,000
Santa Barbara Valley	108,000
Two islands	150,000
Total	1,088,000

The Santa Barbara Valley lies between the Santa Ynez Mountains and the sea, and has a world-wide celebrity for the fertility of its soil and the healthfulness of its climate.

The Santa Ynez Valley, situated between the Santa Ynez and San Rafael ranges, comprises about 120,000 acres of excellent arable land, mostly rolling. The Santa Ynez River runs the whole length of the valley, which is also watered by numerous creeks. The climate differs from that of Santa Barbara, being warmer in summer and cooler in winter, but the heat is dry and not oppressive, cool nights being the rule, while the winter is clear and bracing.

The Los Alamos Valley comprises about 40,000 acres of the richest of agricultural land, and as much more of excellent grazing land in the hills tributary to it. The valley is situated between two ranges of hills or low mountains, that separate the Santa Maria and Santa Ynez valleys, and about 25 miles back from the coast.

Santa Maria, the largest and northernmost valley of Santa Barbara County, lies along the river of the same name, on the boundary of San Luis Obispo County. This valley, including its upper extension, the Sisquoc, is 30 miles from the foothills to the sea; its width, including the adjacent mesa lands, is from 3 to 10 miles. Many tributary cañons break into it through the hills, mostly small, but containing rich, protected, and generally well-watered land, excellently adapted to all kinds of deciduous and citrus fruits. The main valley has perhaps as varied resources as any in the State, on account of its large extent and consequent differences in climate and soil. On the west it opens to the sea, and has a heavier soil and more fog. The soil of the middle valley is a sandy loam, while that of the Sisquoc and the tributary cañons is deeper and richer. The lower and northern valley, especially the Oso Flaco side, grows large crops of beans, potatoes, etc., while farther up wheat and barley are yet grown. The beet-sugar industry is now assuming large importance in this valley, a sugar plant, costing $1,000,000, having been built in 1898, and employing 500 hands in the sugar-making season. In 1901 over 90,000 tons of sugar-beets were produced, making 100,000 sacks of granulated sugar, the only product marketed.

LOMPOC AND VICINITY.

Lompoc is the center of a very fertile farming and dairying section. It has a population of 1,500, a bank with $145,000 in deposits, a fine high school building, and a grammar school building costing $15,000; is on a branch of the Southern Pacific, 9 miles from the main line at the ocean, and is an up-to-date town in every particular. The town owns its water-supply, maintains a fire department, and has well-graded streets. There are two weekly newspapers published in the town, and two good hotels provide for the traveling public. The section tributary to Lompoc is very well adapted to dairying, and the people of that neighborhood are justly proud of their creamery, the product of which is the most popular butter made in this section of the State, and is as fine as is produced anywhere. Lompoc seems the natural home of the apple, and its product has taken the first prize at the great fair at New Orleans, and at Chicago was awarded a diploma of excellence. The codling moth is here unknown, and Lompoc apples are never "wormy," so there is every prospect that this industry will eventually become of the first importance, especially as the demand for Lompoc apples always outruns the supply. Another production of which Lompoc has a monopoly for the United States is English mustard, which is here grown on a large scale.

CLIMATE.

Few portions of the world, if any, can show such a remarkable climatic record as the city of Santa Barbara and the contiguous valley. The following table, showing the average highest, lowest, and mean temperatures, relative humidity, rainfall, and average movement of the wind, is compiled from records carefully kept at the city of Santa Barbara by that accurate observer and mathematician, Mr. Hugh D. Vail, in his lifetime, and since his death in June, 1900, by James A. Dodge, Professor of Mathematics in the Santa Barbara High School. With the exception of the wind movement, the observations of which extend over a period of twelve years, the record covers a period of a third of a century, and may be regarded as fairly typical for all time:

Month.	Average of Highest Temperature	Average of Lowest Temperature	Mean Temperature	Relative Humidity	Average Rainfall	Average Hourly Movement of Wind.
				Per cent.	*Inches.*	*Miles.*
January	74.8°	37.1°	53.5°	67	3.73	3.5
February	78.2	36.1	54.8	69	3.21	4.0
March	79.8	38.3	55.7	70	2.28	4.5
April	82.0	40.8	58.0	71	1.18	4.6
May	82.2	44.5	59.3	73	.36	4.5
June	85.4	47.9	62.5	74	.10	5.0
July	86.7	52.3	65.2	76	.02	4.2
August	87.0	53.5	66.7	75	.00	4.0
September	88.2	50.5	66.0	75	.22	3.6
October	87.9	47.3	62.6	72	.73	3.5
November	84.0	43.2	60.0	66	1.54	3.1
December	77.1	38.6	55.7	65	3.63	3.5
Means	82.7	44.1	60.0	71	17.00	4.0

The record for the year 1901 shows the mean temperature to have been 59.7°, being .3° below the normal. The highest temperature recorded was 96°, and but for one day only. The next highest was 90°, and that for one day only. The thermometer registered above 80° on but twenty days during the year, distributed as follows: February, 2; March, 2; May, 1; June, 3; July, 1; August, 5; September, 1; October, 3; and November, 2. The lowest temperature was 35°, and the thermometer registered below 40° on fourteen nights only. The warmest night during the year showed a temperature of but 63°. During the year there were 150 clear days, 147 fair days, and 68 cloudy days. There was a great deal more cloudy weather than usual, the average of clear days, taking one year with another, being about 240. The rainfall for the year was 15.27 inches, being 1.73 inches below the average. The average hourly movement of the wind was 3.5 miles per hour. The greatest movement on any one day was 275 miles, on the 22d of March, or an average for that day of about 11 miles per hour.

PRODUCTS OF THE SOIL.

The arable soils of Santa Barbara County are mostly alluvial and adobe. The alluvial soil is generally deep and rich, and will grow all kinds of field crops, such as beans, potatoes, corn, and vegetables of all kinds, strawberries and all other kinds of small fruits. In addition to the fruits usually grown in the Eastern States, this soil will produce prunes, figs, olives, peanuts, English walnuts, grapes, plums, lemons, limes, oranges, loquats, guavas, persimmons, cherimoyers, dates, bananas, and many other semi-tropical fruits. In fact, nearly every tree, shrub, or plant that grows in the world can be grown out of doors in the southern part of Santa Barbara County.

The adobe soil is very rich, but more difficult to work. It, however, produces large crops of oats, wheat, barley, flax, and mustard, and affords also the richest of pasturage.

The principal crops of Santa Barbara County are hay, barley, wheat, English mustard, apples, olives, lemons, walnuts, beans, and sugar-beets. The principal mineral productions are asphaltum and petroleum.

A large portion of the county, especially that of a hilly or broken character, is devoted to stock-raising, which is as yet the principal industry. During 1901, there were shipped out of the county, 22,000 head of cattle, 7,000 cows, 2,500 calves, 4,500 hogs, 65,000 sheep, 5,000 horses, and 1,500 mules.

The following figures for the agricultural products of 1901 and also the horticultural output would indicate that Santa Barbara County is entitled to credit for something more than climate:

Barley	540,000 sacks.
Wheat	300,000 sacks.
Oats	134,000 sacks.
Hay	60,000 tons.
Beans, Lima	12,600 sacks.
Beans, Navy	200,000 sacks.
English Mustard	6,000,000 pounds.
Olive Oil	36,000 bottles.
Walnuts	1,000 tons.
Sugar	100,000 sacks.
Lemons and Oranges	$300,000 worth.

The many other products of the county bring the total output for the year to about $6,000,000.

INDUSTRIAL IMPROVEMENTS.

The completion of the coast line of the Southern Pacific through the county has given a great impetus to every branch of industry. The oil development in the northern part of the county has been a marked feature of the year, and there is every prospect that this county will soon become one of the largest producers of petroleum in the State.

There has been of late a very decided improvement in the industrial outlook for the county. In the city of Santa Barbara alone, improvements in the shape of buildings and street railway extension aggregate about $800,000. The Pacific Improvement Company is perfecting a system of water works for its suburban tract, the Hope ranch, which will cost, when completed, about a quarter of a million dollars. Lompoc has voted $40,000 for bringing water into that valley, and Santa Maria has spent $10,000 toward an irrigating plant.

The population of the county is something over 20,000. That of Santa Barbara City between 7,000 and 8,000.

Among the improvements for the near future is a hotel to cost something over $500,000, ground for which was broken on January 19, 1902. It will be located on Burton Mound in the city of Santa Barbara, and will be unsurpassed by any hostelry in the State. It will supply the long-felt need of the city for a modern and capacious tourist hotel.

PRICES OF LANDS.

The cost of farming lands in this county remains about the same as for several years past, though an improvement is manifest in some sections. Good land in the Santa Maria Valley is worth from $50 to $75 per acre, unimproved, while such land in the Lompoc Valley brings from $75 to $100 per acre. There are sections of the county where land may be purchased at a cheaper rate, but it is not so conveniently located as regards railroad and shipping facilities. Grazing lands may be bought for $10 per acre upward. Land in the vicinity of the city of Santa Barbara is worth from $200 to $300 per acre, unimproved. Sometimes a choice residence property is sold for much higher figures, but these prices represent a fair average for Goleta and Carpinteria valley lands, and these are among the richest in the county. The outlook for small fruits and vegetables in the vicinity of Santa Barbara is having the effect of creating a demand for small holdings, and there is a marked increase in the values of such property. The expected increase in the city's population will tend to produce this effect as the demand for the city market broadens.

SANTA CLARA COUNTY.

Santa Clara County has an area of 1,750 square miles—1,120,000 acres. It is surrounded by Alameda County on the north, Stanislaus and Merced on the east, San Benito on the south, and San Mateo and Santa Cruz counties on the west. The county is near the geographical center of California, and immediately south of San Francisco.

TOPOGRAPHY.

Its eastern boundary is the summit of the Coast Range, and its western the crest of the Santa Cruz Mountains. It extends southward 52 miles and has an average width of 34 miles. Its principal valley is the Santa Clara, which is 34 miles broad at the north and has an average width of 15 miles. Encircling the level lands of the valley is a wide region of rolling hills, beyond which rise the mountains, culminating at the western side in Mount Bache, 3,780 feet, and on the east in Mount Hamilton, 4,250 feet. Of the total area of the county it is estimated that 800,000 acres are suitable for the cultivation of fruits and vines; of these something more than 250,000 acres are in the valley and 300,000 acres in the foothills.

Looking down the valley from some elevated point in the surrounding hills, the general contour presented is that of a level plain, while it is, in fact, a series of gentle undulations, with marked variations in the character of the soil. In what is now, or recently has been, the lower portion of this plain, the soil is a black, tenacious clay known as "adobe." While very fertile and productive, it requires much care as to the time and manner of cultivating it, and is well adapted to hay and grain. The higher lands of the valley are a light, loamy, and sometimes gravelly soil. This is easily cultivated, and is adapted to all kinds of cereals and most varieties of fruits.

The "warm belt" is a tract upon the slopes of the hills which environ the valley. It has an altitude of from 600 to 2,000 feet. It is generally, and in some localities wholly, free from frost. In this belt, to the east of Milpitas, potatoes, peas, tomatoes, asparagus, strawberries, etc., are grown through the whole winter for the San Francisco market.

SOILS.

Upon the Los Gatos and Guadalupe rivers, in the immediate vicinity of San José, are some hundreds of acres, formerly dense willow thickets, but now in the highest state of cultivation. These lands, which are known by the general name of "The Willows," are regarded as the most desirable in the valley, and abound with lovely homes surrounded by splendid orchards. The soil is a sedimentary deposit, easily cultivated, requiring but little irrigation, and producing every variety of fruit and vegetable common to California.

In the southern portion of the valley the soil is especially productive. Over a considerable portion the subterranean moisture maintains the growing pastures throughout the year, and some of the most successful dairies in the State are established there. The more elevated portions of this part of the valley are well adapted to fruit and vines.

So wide is the divergency in the character of the soil in different localities, that agriculturists are reluctant to express an opinion as to comparative merits, each section having demonstrated its fitness for growing some of the almost endless varieties of fruits and vines, which are here cultivated at almost fabulous profits. While there is no better soil in the world for the production of wheat and barley, the area devoted to the cultivation of these cereals is yearly decreasing, owing to the much greater remuneration obtainable from the growing of fruits, grapes, berries, and vegetables.

Alviso district has rich black loams, so highly prized for small fruits and vegetables, and the San José and Santa Clara regions have lighter loams and sedimentary deposits, valued for stone fruits. The shallower gravelly loams of the hillsides are also very desirable. Along the streams the land is deep, well drained, and very rich in desirable elements. Red chemisal and chaparral land on the hillsides of Santa Clara Valley has recently been put in fruit. Although reddish brown when dry, and inclined to form hard lumps, its supply of potash, lime, and humus is such as to promise very well under good cultivation.

The higher lands are of light loam, and in some places gravelly. They are composed of a black, tenacious, and wonderfully fertile clay loam. Along the banks of the streams the soil is of great depth and richness, while on the borders of the bay are thousands of acres of salt marsh, which, when reclaimed, is found to be the most productive.

There are many small farms, and diversified farming is the rule.

WATER-SUPPLY.

The valley is drained by a number of streams, the principal ones being the Los Gatos, Guadalupe, and Coyote rivers. In summer time these watercourses greatly diminish, and the smaller ones wholly disappear. Having their sources in the surrounding hills, and sinking as they approach the valley, they augment the subterranean resources which supply the artesian wells. These are found all over the valley. They are usually from 60 to 100 feet in depth, though some find a larger and more permanent supply at a much greater depth. In the country the water is raised by windmills into tanks, furnishing an ample supply for household and gardening purposes, while the cities and larger towns are provided with reservoirs and complete waterworks systems.

CLIMATE.

The mountain ranges which surround the Santa Clara Valley very materially modify the climate, shutting off, to a great extent, the fogs which prevail on the immediate coast, and the hot winds from the San Joaquin Valley on the east. There is a so-called winter and summer, but the roses bloom in gardens through both of these seasons with an equal beauty. It has a wet season and a dry season, the former a succession of showery days, alternating with days of fair weather and brilliant sunshine. The dry season is not so dry as to blight the foliage of such trees and shrubs as require moisture for their subsistence.

The tops of the surrounding mountains are whitened with snow every winter, but the winds come into the valley from the north, and not from the mountains, so that these snowy ridges do not chill the air. Since the advent of the white man into the valley, snow has fallen but twice, and then melted on the same day. The temperature varies from 50° in the wet season to 80° in the dry. On rare occasions the thermometer may show a little higher temperature during the warm months. The summer is as free from heat as the winter is from cold. The selfsame breeze from the bay that cools the air in summer warms it in winter, drawing its own temperature from the unchanging ocean.

Along the slopes of the mountains on either side of the valley, at an elevation ranging from 660 to 2,000 feet, exists a region known as the thermal, or warm, belt. When there is a heavy frost in the valley below during the night, there is no sign of frost on these elevated tracts of land. This anomalous distribution of heat is explained by the fact that during the day the lower stratum of air in the valley becomes heated and gradually rises up en masse, its place being supplied by the cold air flowing in from the north, near the surface of the ground, that has been cooled by radiation during the long winter nights. Orange trees planted in these thermal belts, at an elevation of more than 2,000 feet, suffer little from the ravages of frost.

The rainy season lasts from October to April. In the latter part of September the signs of a coming change are apparent. The winds, which have hitherto come from the north, now become variable both as to direction and force, or perhaps wholly cease. The stillness of the night is broken by fitful gusts which, while wailing through the trees, are the precursors of the coming winter. In the first ten days of October about an inch of rain will fall, followed by weeks of the finest weather.

The effect of these first rains is magical. It washes the dust from the foliage, and the earth puts on the freshness of spring. While in the East the year is gently dying, here a new year is apparently springing into existence. If in this and the succeeding months there are further showers, the grass springs up on every hand, the hills change their subdued coloring for a lively green, and wild flowers appear in every sheltered nook. The flowers supposed to be coincident with spring bloom in the gardens, and the perfume of the violet scents the air. It is not until the end of November or the beginning of December that the rainy season is fully established. A coming storm is now heralded by a strong, steady wind, blowing for a day or two from the southeast, followed by several days of rain, and these succeeded by days and even weeks without a cloud. And so, for six months from the time of the first showers, occasional storms alternate with periods of fair weather. The amount of rain which falls during the winter varies with the locality, from 15 to 35 inches being a fair estimate throughout the valley. Taking an average of a series of years, it appears that of the 182 days which comprise the rainy season, on 43 days in each year more or less rain fell; 69 days were cloudy; the balance bright and pleasant. Thunder storms are practically unknown, the low rumbling being only occasionally heard on the mountains many miles distant. Severe wind storms and cyclones, so common in some of the interior

States, are wholly unknown here, and as before stated, snow has but twice fallen since the advent of the white man.

With the month of March the rains are practically over, though agriculturists expect and hope for showers in April. May has perhaps a few showers during the first ten days, which interfere with the harvesting of the first hay crop, and then the dry or summer season is in full swing. By July the surface moisture has been taken up and dissipated, and the growth dependent upon it ceases. The nutritious grasses have ripened, and self-cured and dried are the food of cattle and sheep. The waving fields of golden grain await the reaper.

THE LEADING INDUSTRIES.

Santa Clara is preëminently the horticultural county of the State. Every variety of fruit grown in California is produced here, but the chief of all the horticultural pursuits of the county is prune-growing. Of the prune crop of California, Santa Clara County produces nearly two thirds. With improved facilities for marketing, this industry has, within the last ten years, assumed marvelous proportions. The largest fruit canneries in the world are operated at San José, the leading city of the county.

Olive-growing is assuming prominent proportions, and it is only a question of a few years when it will become one of the leading industries of the county.

Almond culture is extensively followed in the county, and the nut grows to perfection in both size and flavor.

Pears do exceedingly well and grow in any part of the county; large quantities are shipped to Eastern points, and a considerable portion of the crop is either canned or dried.

Apples, especially those raised in the foothills or on the mountain sides, are of a very superior flavor and size.

Apricots of all varieties are grown and reach a very high standard of quality. The bulk of the crop is mostly canned or dried, but a large quantity is shipped green, and, next to prunes, it is the largest fruit industry.

The peach is cultivated on a large scale. A large quantity of the crop is either canned or dried, although a considerable portion of the crop is shipped green. Santa Clara peaches find a ready sale in the East, on account of their excellent flavor and large size.

Cherries of all varieties grow in profusion. The cherry is one of the best shipping fruits in the county, and is very profitable to growers thereof.

While the culture of citrus fruits is not as extensively carried on as it might be, those grown in the county compare favorably, as to flavor and size, with those grown anywhere in the State.

Grapes flourish, particularly the wine varieties, and many new vineyards have recently been planted. The outlook for this industry is particularly bright, and the product of the vineyards finds a ready sale to the numerous wineries throughout the county.

Berries of every description are grown, and the crop is a very prolific one.

Vegetable farming is increasing every year and great quantities of all kinds are shipped to the San Francisco market. Asparagus in particular is one of the most profitable vegetables grown; many tons are shipped green, and several hundred tons are canned especially for the Eastern market.

The raising of seed, both flower and vegetable, is on a very extensive scale in this county, and large quantities are shipped to all parts of the world.

The dairy interest is very extensive. The butter and cheese yield is of a high standard and the product of the county is known to be of a very superior quality. There are several up-to-date creameries in operation throughout the county.

Poultry-raising, in all its branches, receives considerable attention, and it is a very profitable industry. Some of the finest chicken yards, stocked with the choicest birds to be found in the State, are located in the county.

The raising and feeding of cattle for market is not, owing to the increased value of land, carried on as extensively as in former years. Natural grasses are to be found on the remaining ranges, and very nutritious pasturage can be obtained the year round.

PRINCIPAL TOWNS.

San José is the county seat; it has the finest educational establishments of any city in the State.

Palo Alto is a rapidly growing town. The Leland Stanford Junior University is located there.

Gilroy, Santa Clara, Mayfield, Los Gatos, and Saratoga are all prosperous, as are many other smaller towns throughout the county.

The last report of the United States General Land Office gives the acre of unoccupied government land as over 30,000 acres, chiefly mountainous.

SANTA CRUZ COUNTY.

Santa Cruz County fronts its entire length on the Pacific Ocean, and lies midway between Oregon on the north and Lower California on the south, and is in the heart of Central California. Its boundaries, besides the ocean on the west, are San Mateo on the north, Santa Clara on the east, and Monterey on the south. It is separated from San Mateo and Santa Clara counties by the Santa Cruz Mountains, and from Monterey by the Pajaro River. It has an area of 437 square miles, or 280,000 acres.

It is one of the smallest counties in the State, and comprises a narrow strip of mountainous land about 40 miles long and 18 broad, forming a vast amphitheater, and sloping from the summits of the Santa Cruz range, whose highest elevation, Loma Prieta, is 4,000 feet, southward and westward to the bay of Monterey.

TOPOGRAPHY.

The curving line of shore and the corresponding curve of the mountain line inclose an irregularly crescent-shaped tract of country, with an average width of 20 miles, which for grandeur, beauty, and variety of scenery equals any tract of similar size in the world.

The innumerable ridges and spurs of the Santa Cruz range are intersected and furrowed by gorges, cañons, and narrow valleys, trending for the most part seaward. The sides of these are closely set with forests of pine, redwood, madrone, and other trees, the redwoods having, in many cases, attained gigantic growth. A number of streams rise in these hills, and bring down with them the rich alluvial loam into the valleys, which, in their normal condition, are smiling with native grasses and flowers, and as soon as "tickled with a hoe" yield phenomenal agricultural results. These streams are, agriculturally as well as topographically, a very important feature of the county, watering as they do every section of land. Besides these larger streams, springs of water are almost innumerable.

Nearing the coast there are many interesting topographical features. The leagues of wide, high, wind-swept grassy plateaus which form our remarkable grazing and dairy lands; the succession of chalk terraces; the broad amphitheatrical valley of the Pajaro; the salt lagunas, picturesque in configuration, and surrounded by park-like groves of live oaks; the high sandstone cliffs along the shore; the magnificent ocean drives—all material for pleasant investigation.

SOILS.

Along the coast-line (except in the northwestern corner of the county, at which point the mountains come down nearly to the water's edge) a series of raised beaches form a strip of more elevated land along the seashore. This widens to the south of the city of Santa Cruz, and affords a large area of fruitful soil, which has been brought into a high state of cultivation.

From Santa Cruz city southward the soil consists of a light loam, abounding in lime, potash, and phosphoric acid. In the Pajaro Valley a great variety of soil is found, from the rich sedimentary alluvial wash to the light sandy soil of the foothills. In the lower part of the valley a clayey loam predominates. This is followed by a heavy adobe higher up, and then the dark, reddish loam of the plains. The latter is the favorite with fruit-growers, and it is here that the best orchards are found.

RAINFALL.

The average annual rainfall of Santa Cruz, taken from a record of thirty-two consecutive years, is 25.26 inches, showing that this is a well-watered district as compared with the State of New York which has an annual rainfall of 19.04 inches.

THE COUNTY'S VARIED INDUSTRIES.

The specialty of Santa Cruz is her infinite variety. In lumber products she ranks third in the State. Her butter, cheese, and cream might well win her a place in the dairy districts. Hay, grain, potatoes, and the whole range of cereals and vegetables give enormous yields per acre, and while she does not claim to wear the citrus belt, yet oranges are raised for home consumption, and the cultivation of the lemon for market is a successful and profitable business, since the immunity from frosts and equable seasons favor its arriving at fine maturity. But her deciduous fruits, large and small, her table and wine grapes, her fine wines are winning renown the world over. From the summits of the range, more than 2,000 feet above the sea, down to the wide and fruitful valleys along the bay coast, grow and flourish a range of the most delicious fruits which no spot on earth of similar size may successfully rival. Prunes, pears, apricots, lemons, peaches, cherries, Japan and native plums, figs, walnuts, persimmons, olives, and nectarines thrive, but the crop in which the largest profit is found is undoubtedly that of apples. The quality and size are astonishing, and the yield per acre as much so. From Bellflowers in September to Newtown Pippins in December the supply is steady, and the work of harvesting and shipping drives the orchardist merrily. From two depots in the county, in a late season, there were shipped to Eastern points, exclusive of other sales, 128,596 boxes of apples, weighing 6,429,800 pounds. The market for Santa Cruz County apples now extends to England and the Continent, Germany being a large buyer. The acreage now in bearing will supply not less than 2,000,000 boxes annually. The especial home of the apple, as well as of the strawberry, in this county, is the fertile valley of the Pajaro River, and the flavor and color of the foothill apples are renowned also.

Of the small fruits, the strawberry is most widely grown, and furnishes a practically continuous crop. Raspberries, blackberries, Japanese wine-berries, and the Loganberry, which originated in Santa Cruz, yield unfailing crops. The Loganberry is a cross between the wild blackberry and the Antwerp raspberry, and fruits in two varieties, red and black. The berry is large and luscious, and is now being grown widely in the Eastern-Southern States as well as in California.

The wines of this county are winning the place they deserve in the markets of the world. This product of our vineyards is now shipped to the heart of the wine countries of Europe. Our white wines go to the Rhine, our red wines to Bordeaux. The Ben Lomond wines of Santa Cruz County were exhibited and won gold medals at the World's Exposition in Paris, at the Columbian Exposition in Chicago, at competitive exhibits in Bordeaux, and at the San Francisco Midwinter Fair. The Santa Cruz wine trade with China and Japan is also good and growing.

The sugar-beet industry is a profitable one. A large acreage in the southern part of the county is devoted to the growth of the beets, and a well-equipped factory reduces them to sugar.

Santa Cruz ships thousands of tons of hay and many train-loads of potatoes annually. Potatoes yield phenomenally in the rich bottom lands; asparagus is grown for outside markets; hops and beans are each good enough in results for farmers to give them special attention.

Market gardening is profitable, and many comparatively small industries are making an honest living for those who follow them. Among these are cucumber-growing for San Francisco and Eastern cities; seeds, bulbs, and cut flowers for metropolitan markets.

Dairying is a flourishing and profitable interest in Santa Cruz, and the fifty thousand and more acres of grazing lands have for many years supported herds of well-selected stock. The grasses are rich and the county's products of cream, milk, butter, and cheese have a good repute at home and abroad.

A typical dairy and creamery farm lies just north of the city of Santa Cruz. It comprises 2,330 acres, rolling up from the ocean rim, and well watered by mountain streams. The principal of these furnishes power that generates electricity, and it is probable that there are few creameries in the United States where the electric current is harnessed down to so many and such varied duties. Only about 500 cows are kept, but they are of the choicest. Many other dairies graze herds of from 300 to 500 cows, and make both cheese and butter.

The poultry interest needs fostering all over California. The large importations of eggs and fowls from Eastern districts are especially discreditable, in view of the fact that there is no winter weather from which to defend the poultry, while every condition is favorable to the profit and the prosperity of the industry. While Santa Cruz produces and ships many eggs, and while they are of so good a keeping quality that they are in special demand for exportation to the Orient, yet the business might easily be increased many hundred per cent, especially as not enough chickens and turkeys are raised to supply the home market. The wholesale dealers of San Francisco do not hesitate to express their preference for Santa Cruz County eggs over those from the drier and hotter counties of the interior, their keeping qualities being far superior.

The deep-sea fisheries of Santa Cruz are important factors in her prosperity, and here again there is room for indefinite expansion. The waters of the bay teem with food fish; the pools and rocks along the shore support quantities of shellfish; and the streams that come down to ocean and bay are the homes of the mountain trout.

Many industries have developed to the profit-producing point, and the general air of thrift and prosperity throughout the county is satisfactory. From what has been already said it will be evident that one vast source of wealth of the county, past, present, and prospective, is its forests. Redwood lumber is durable, non-inflammable, and capable of receiving a rich finish for interior and cabinet work. The output of the county has been large for many years, but large tracts of forest remain, and the redwood is rapidly reproductive, giving promise that the supply for the future shall be continuous. There are fifteen lumber mills in active operation in the county. Many of the trees are giants of ancient growth, and it is not uncommon to see thirty-five thousand feet of clear lumber cut from a single tree. The by-products of shakes, shingles, railroad ties, piles, telegraph poles, fruit-box shooks, pickets, posts, etc., are manufactured in large quantities.

Eight varieties of oak grow here, among them the chestnut oak, which supplies tanbark for the making of superior leather. The manufacture of powder, besides requiring redwood and oak for fuel, utilizes willow, alder, and madrone. Redwood, laurel, and madrone are all practically used as cabinet woods, and this industry is susceptible of an indefinite development, so numerous and varied are the native woods of the county.

Naturally, wood is the fuel in general use, and it is of the best quality and cheaper in Santa Cruz than in any Central California county. Especially interesting to lovers of trees are two localities within easy reach of Santa Cruz. The "Big Tree Grove" is but five miles from town, on the line of the railway in the fine cañon of the San Lorenzo. This is an ancient grove of giants, not the *Sequoia gigantea* of the Sierras, but the *Sequoia sempervirens*. It covers twenty acres, and numbers scores of trees from ten to twenty feet in diameter, and a dozen or more which exceed that diameter and reach a height of three hundred feet.

In the mountains lying near the coast there were discovered years ago deposits of a material, unique and strange in substance, which, under the name of bituminous rock, has proved of untold value as a natural pavement material. It has now been used on the streets and sidewalks of Santa Cruz and other places for sixteen years, and when laid on a proper foundation, proves durable, clean, elastic, and as nearly perfect as possible. It appears to be a natural combination of bitumen, sand, and crude petroleum. It is now shipped to all near-by cities, and goes farther afield to Salt Lake City, Tacoma, Seattle, Phœnix, Ariz., and to Honolulu. A recent shipment of one thousand tons to Honolulu was to fill a government contract made after close examination and investigation by government experts. The industry, already flourishing satisfactorily, will find no limit to its activity in a century to come, so far as the supply is concerned.

Very similar conditions exist regarding the vast deposits of high-grade lime rock throughout the mountains. Five kilns are in active operation, the employés and their families, like those of the lumber mills, constituting populous little settlements, and many cargoes per month are shipped to distant points.

PRINCIPAL TOWNS.

Santa Cruz is the county seat, with a population of over 6,000.

Watsonville has a population of 4,000, and is one of the chief shipping points; last season there were over 2,000 carloads of apples shipped.

Other growing towns with fine educational facilities and thriving surroundings are: Soquel, Aptos, Felton, and Glenwood.

SHASTA COUNTY.

Shasta County is situated at the head of the Sacramento Valley, between parallels of latitude 40° 20′ and 40° 15′ north, and longitude 120° 20′ and 123° west. It is bounded on the north by the counties of Siskiyou and Modoc, on the east by Lassen, on the south by Tehama, and on the west by Trinity. Its greatest length from east to west is 90 miles, and its greatest breadth from north to south is 60 miles. Its area is 3,765 square miles, or 2,409,600 acres.

TOPOGRAPHY.

The mountains of the Sierra Nevada and Coast Range cover a large portion of the county on all sides except the south. They are rugged and lofty, rising more than 5,000 feet above the sea. On the east there are four peaks of special prominence, that stretch far into the county from the Sierra, separated from each other by a space of from 10 to 12 miles. Lassen Peak has an altitude of 10,577 feet, and is timbered for two thirds of the way up; the others are bald, and usually covered with snow. Other peaks and buttes are numerous, and all indicate volcanic origin, as shown by extinct craters, cones, sulphur deposits, beds of lava, etc. Hot and boiling springs are also of frequent occurrence.

In the southern portion of the county is a foothill region, half circular in shape, forming the northern end of the Sacramento Valley proper, and embracing about 500,000 acres, the altitude of which is from 500 to 2,500 feet above the level of the sea. The southwestern portion of this foothill region is a succession of rounded hills, varying in height from 50 to 200 feet above the level of the sea. The central and southern portions consist of table-lands, varying in altitude from 500 to 700 feet above sea-level. It has many narrow valleys. From this section eastward there is a gradual ascent to the mountains, embracing the higher foothills of the Sierra.

WATER-SUPPLY.

Shasta is noted for the number and beauty of its streams. First in importance is the Sacramento River, flowing through the county north and south; all but 20 miles of its course in the county is through a rocky cañon. The McCloud River, bursting from Mount Shasta's side, rushes through the mountains of the north in a southerly direction and empties into the Pitt River. The most beautiful stream of the northeast is Fall River. In its meanderings it is 40 miles in length, and empties into Pitt River. Besides these larger streams there are a score of tributaries or creeks, while springs abound in the foothills and mountains. Among the minor streams are Hat Creek, Roaring River, Hatchet Creek, Montgomery Creek, and on the north, Squaw Creek, McCloud River, and the Little Sacramento. These three have many features in common. They take their rise in the highest mountains around Mount Shasta, flow south, are clear, very cold, and very rapid, each about 100 miles in length, and fall into the Pitt River within a distance of 15 miles. Below this point comes Clear Creek from the west, Churn Creek, Stillwater Creek, Cow Creek, and Butte Creek from the east, the last forming the boundary between Shasta and Tehama counties on the east, as Cottonwood Creek does on the west. Cow Creek is a large creek, having many branches, all rising in the high Sierra. Battle Creek receives the waters from the west side of Lassen Butte, as does Hat Creek on the east side. These two creeks have sources close together; each is from 30 to 40 miles in length. The former empties into the Sacramento River, the latter falls into Pitt River 80 miles above, at an elevation of 2,500 feet. Besides these streams there are a great many others of smaller size. Numerous springs are found, and water in abundance for all needs exists.

SOILS.

The soil of the valleys is an alluvium, a rich sedimentary deposit, largely intermixed with disintegrated rock, and in some parts with a mixture of gravel. The usual color is a light red or reddish brown. The soil is very fertile, and is found excellent for plums, prunes, pears, figs, and small fruits. The mesa lands bordering the valleys are, as a rule, composed of a sandy loam, with a large percentage of clay, and carrying in many portions, especially in the higher parts, considerable gravel and bowlders. Fruit of nearly all kinds does well on these mesa lands. On the foothills is found a red loam or clay, very productive, and excellently adapted to the growth of berries. On the elevated plateaus of the north and northwest the soil varies from a black, sandy loam to a red loam or clay, while to the southwest the soil is generally adobe, found very productive of grain and rich in natural grasses.

CLIMATE.

Almost any desired climate may be found, from the semi-tropical to that in which the cold winter and short summer prevail. The rainy season, which begins in September, is the most delightful part of the year. It is perfectly clear and warm between rains. In the higher altitudes the climate varies. Snow storms are frequent, but not heavy or of long duration. The ground never freezes more than an inch or two in depth. The foothills have an excellent climate, neither an extreme of heat nor of cold. In the valleys in the east and northeast portions of the county the seasons—summer and winter—are similar to those of the Eastern States, only less in the extremes of heat and cold, the same as anywhere else in the interior portions of the State, there being only from 2° to 4° difference in extremes of temperature here and at the extreme south end of the San Joaquin Valley at Bakersfield. Weather is delightful in March, April, May, June, September, October, and November; hot in July and August; rainy in December, January, and February.

Irrigation is unnecessary for most crops in many portions of this county, as the rainfall is sufficient for all ordinary purposes. The rainy season begins, as a rule, in September, never later than October, and extends, at intervals of two or three weeks, from that time until the middle of the following June. During the entire time the ground is thoroughly saturated with moisture. This rainy period covers the whole of the growing season in California. At the end of the rainy season grains, grasses, etc., are ready for the harvest, and fruits, grapes, etc., are beginning to ripen. Now follows the dry season, embracing the months of July, August, and September. Under a cloudless sky crops are harvested and stored away, and fruits mature and acquire the delicious flavor for which they are noted. The dry season is just as much of a necessity as the wet, for only under these conditions can perfect grain and fruit be grown.

SHASTA'S NATURAL RESOURCES.

Beautiful resorts and health-giving springs abound in all parts of the county. The high mountains are generally heavily timbered with sugar pine, cedar, fir, and other valuable timbers. Some large valleys and extensive plateaus are found, however, and are mostly devoted to general farming, stock-raising, and wool-growing, the climate being similar to that in the East, only much less severe. The foothills, varying in altitude from 800 to 2,000 feet above sea-level, are more or less timbered with oak and pine, and their higher portions yield all kinds of minerals and stone, such as gold, silver, copper, iron, platinum, quicksilver, lead, marble, sandstone, limestone, coal, onyx, etc., affording also many opportunities for lovely homes to the small farmer, fruit-grower, stock-raiser, poultryman, and gardener. Water is abundant and of excellent quality, coming from springs and small creeks. The climate of this section is perhaps the most pleasant of any, and is not extremely hot in summer nor very cold in the winter or rainy season. The valleys are very fertile and capable of producing all products grown in the temperate or semi-tropical regions.

An industry that promises to develop to a great extent in the future is the culture of the apple. At certain altitudes, crisp and luscious apples are produced, and the quantity and quality can not be surpassed. Good profits reward the apple-grower, and at no distant day the present moderate acreage devoted to the cultivation of the apple will be largely augmented.

Truly it may be said of Shasta that it has passed the experimental stage. Its orchards are a success, producing heavy crops of all kinds of fruit and of the very best quality. The prune, peach, pear, plum, apple, apricot, almond, fig, lemon, orange, and olive thrive, if care is used in the selection of land and location, with reference to the fruit desired to be grown. Large bearing orchards are scattered all over the county, but the continuous ones are found along the river from Cottonwood to and above Anderson; in Happy Valley, 12 miles southwest of Redding; in Churn Creek bottom, 6 miles southeast of Redding; on Stillwater, 6 miles east, and about Millville. Grapes of wine, table, and raisin varieties have proven a success in all the valley portions of the county, and many gallons of wine are made and shipped to different parts of the country; so with raisins. Wheat, grass, and alfalfa are grown everywhere successfully, water being needed for alfalfa. The markets are the best in the State, as there is home consumption for everything produced except fruit, and hundreds of carloads in addition to the products raised here are shipped in annually, consisting mostly of grain, hay, butter, eggs, and vegetables. The producer here receives for his products the prices paid at Marysville, Sacramento, and other shipping points, freight and commission added from there here. The home-seeker will find land here adapted to grain-growing, hay-making, poultry-raising, or gardening at less prices than in the older settled portions of the State, prices ranging from $25 to $100 per acre for good land, according to location.

Stock-raising is an important factor in the material wealth of Shasta County. The mild winters in the lower altitude obviate the necessity of feeding, while the summer ranges afforded by the mountains make it possible for the stock-raiser to keep his herd upon green feed the greater portion of the year. As a whole, the varied agricultural interests of Shasta County are in a prosperous condition.

The sawmills of the county are an important factor in its industries, and distribute many thousands of dollars annually for labor. The Terry Lumber Company's mills are located on the mountains above Montgomery Creek, and are the largest in the county at present; are connected with Bella Vista by flume; here they have planing mills, yards and dryhouses, and a railway to the main line at Anderson. The wood camp is located in the big bend of the Pitt, and has been sending from 50,000 to 80,000 cords of wood annually down the Pitt to the smelters. They also own and operate a sawmill, and cut from 12,000,000 to 15,000,000 feet of lumber each year.

In the Shingletown country there are seven large sawmills, and during the last year they graded about twenty-five miles of road for traction-engine work, and over this road, with two engines, they transport their lumber to the market on the railroad. At or near Whitmore there are some sawmills which turn out from 20,000 to 30,000 feet of lumber per day, which they freight to the railroad by wagon.

There are three large flouring-mills in the county—one at Ball's Ferry, one at Falls City, and one at Swasey.

The resorts are numerous and mostly easy of access. Near Castella, on the railroad, there are three, where may be found, during the hot season of the year, people from all parts of the Coast, camping out around the soda spring, enjoying the cool shade of the lofty pines, and fishing and hunting for exercise. In the Big Bend country the hot springs are located, and around them are congregated the rheumatic, the sick from most any disease, and many who go for pleasure. The Hurney Falls are also a great attraction to the tourist, not so extensive as the Yosemite, but more exquisite. Clover Creek Falls are beautiful, and the climate there is invigorating, refreshing, and a change from the heat of the valleys.

PRINCIPAL TOWNS.

Redding, the largest city in the county and county seat, is one of the most beautifully located places on the Pacific Slope, commanding as it does a view of both the Sierra and Coast ranges of mountains, with all their lofty snow-clad peaks, and an equally beautiful view of the Sacramento south and cañon north. It is the commercial metropolis of the northern portion of the State.

The next town in importance and size is Taylor, commonly called Keswick, located at the smelters of the Iron Mountain Company, six miles from Redding. It contains a population of about 2,000. All kinds of business are represented and doing well. This town is only five years old, buildings mostly frame. During the past year some very neat new residences have been erected and the town has assumed more of the permanent character.

Millville is one of the old towns of the county, situated in an excellent agricultural section, but mostly occupied by stockmen and old timers who are not sufficiently progressive to take the advantage of the surroundings and utilize their land and water. It contains about 200 inhabitants; the lands surrounding can be bought for about $25 per acre and would be a splendid location for a colony.

Seventeen miles east of there, near Whitmore, is the German colony, who settled in the heavy pine timber fifteen years ago and are now wealthy and prosperous, their chief products being hops, vegetables, apples, berries, and stock. They own a coöperative ditch and irrigate the lands they cultivate.

Kennet and Copley are small towns on the railroad, 18 miles north of Redding. Kennet is the seat of operations for the Trinity Copper Company, and they have erected large and commodious office buildings at this point. For the past eighteen months they have been prospecting and developing their mines, and in the near future will erect a smelter of from 500 to 700 tons daily capacity.

Castella is an important small town of 350 inhabitants, is the base of supplies for the Altoona Cinnabar Mining Company, and the starting point for a short freight wagon road to Weaverville and the Sweepstakes mines of Trinity County.

Shasta, once the county seat and famous the State over for its former glory, is again likely to come into prominence as the center of productive mining regions.

Anderson, a lively town on the California & Oregon Railroad, 12 miles south from Redding, is the chief shipping point for the fruit industry of the county. Many carloads of both grain and dried fruit are shipped annually. The population is 800, and the buildings, as a rule, are very neat. The country surrounding the town is largely valley land, and thousands of acres of bearing orchards are tributary to it.

French Gulch, a town of 500 people supported by the surrounding mines, which were shut down for a number of years, is again the scene of much activity, the mines having resumed work, with promise of better results than ever before attained.

Igo and Ono, two small towns in the western portion of the county and about half way between the city of Redding and Harrison Gulch mining district, are surrounded by mines, and are also in the midst of a good agricultural and stock country.

MINERAL RESOURCES.

From a modest yield of $623,000 in 1896, the value of her mineral product has increased to $7,100,000 in 1901, and the mines of Shasta County are now producing at the rate of over $8,000,000 per annum. When we take into consideration that but one other county of the State is credited with a production of $2,000,000 per year, and that no metal mining county reaches even that figure, the preponderance of Shasta is at once apparent, and the county is classed with such districts as Butte City, Montana, or Cripple Creek, Colorado. Nor is such classification far-fetched; Shasta is merely at the threshold of greatness as a mineral producer. The exploitation of her mineral resources has but begun. At no distant day, single mines will equal in output the product of the county at present—great as it is—and 10,000 men will find employment in her mines, mills, and smelters.

While Shasta's preëminence in mineral production is largely due to the development in copper, her output in the more precious metals is also very large; at the present time exceeding a million dollars a year in both gold and silver. And the production of these metals as a by-product of the copper sulphide ores will with the extension of the industry exceed the present output many times. Shasta's increase in mineral production for the past six years is shown by the following table:

1896	$623,443
1897	2,224,706
1898	3,510,728
1899	4,661,980
1900	5,574,026
1901	7,100,000

The present production is at the rate of over $8,000,000 a year, and it is reasonable to assume that within ten years' time Shasta County alone will produce as much in value as is credited to the entire State at the present time. Nothing can be said to bespeak the future prosperity of Shasta County more eloquently than the figures here produced.

The latest returns of the United States General Land Office give the area of unoccupied land within the county as being over 900,000 acres, described as mountainous, mineral, timber, farming, and grazing.

SIERRA COUNTY.

Sierra County is situated in the eastern part of California, a little north of the center of the State, and lies between 39° 25′ and 39° 46′ north latitude, and between 120° and 121° 03′ west longitude, Greenwich meridian.

It contains an area of 1,000 square miles, practically all of which, except Sierra Valley, is mountainous. The altitude of the county ranges from 2,000 to 8,600 feet above sea-level, the highest elevation being that of the Sierra Buttes; but the bulk of the county has an elevation of from 4,000 to 5,000 feet.

Sierra County is bounded on the south by the mining county of Nevada, on the east by the State of Nevada, on the north by the mining county of Plumas and the agricultural and stock-raising county of Lassen, and on the west by the mining portion of Yuba County.

TOPOGRAPHY.

The main ridge of the Sierra Nevada crosses the eastern part of the county from south to north. Several spurs from the main ridge traverse the county from east to west, forming the watersheds of the four principal streams which form the drainage system of the western part. These streams consist of the Middle Yuba River on the south, with Wolf Creek, Kanaka Creek, and Oregon Creek as its principal tributaries; the North Yuba near the center, with the North Fork, South Fork, Middle Fork, and East Branch joining it near Downieville; and Cañon Creek and Slate Creek on the north; and in the eastern end of the county innumerable streams that form the headwaters of the Feather and Truckee rivers.

In the northern portion there are Bear, Spencer, Gold, Gray, Hawley, Long, Packer, Volcano, Young America, Upper Salmon, Lower Salmon, Upper Sardine, and Lower Sardine lakes, and in the southeastern portion there are Webber, English, Eureka, Meadow, and Independence lakes.

One of the peculiar topographical features of the county is the expansive valleys and lakes lying high up among the loftiest peaks of the Sierra. The lakes vary from one eighth of a mile to three or four miles in length, most of them circular in form, and, considering their small size, remarkable for their great depth.

The most important body of agricultural land in the county is Sierra Valley. This valley, which extends over the boundary line into Plumas County, is the largest, and for its size the most elevated of the valleys of the Sierras, being 4,750 feet above sea-level. It is 30 miles in length and 10 miles in width.

This valley is particularly adapted to stock-raising and dairy purposes, and a very fine quality of timothy and alfalfa hay is raised.

There are several creameries located throughout the valley, and a very superior quality of butter is made, of which most is shipped to outside markets—250,000 pounds being shipped in 1901. Considerable numbers of beef cattle are fattened in the valley for the San Francisco and other markets; besides, large shipments of sheep are made to the same markets.

The soil of the valley is a deep, black loam, largely admixed with rich vegetable mold, the result of ages of forest growth.

$190,000,000 IN GOLD.

Since 1849, when the county was first settled, the principal industry has been gold mining. One hundred and ninety millions of dollars have been taken from its rivers, gravel deposits, and quartz veins—a record second only to that of Nevada County.

TIMBER RESOURCES.

The greater portion of Sierra County is practically covered with a virgin belt of soft timber. In the year 1901 the Loyalton Lumber Company cut and manufactured 13,000,000 feet of lumber; other smaller mills cut several million feet. The Sierra Nevada Wood and Lumber Company cut 28,000,000 feet; the timber for same was mostly cut on their lands in Sierra County. The Verdi Lumber Company own timber land and use a large amount of lumber cut in Sierra County. The Floriston Paper Mill Company also own timber lands, and use a large amount of Sierra County timber at their factory. There was probably 50,000,000 feet of timber cut in Sierra County in the year 1901, and at that rate it has been estimated that the timber lands would not be cut off in fifty years.

STATISTICS.

The population, according to the census of 1900, is 4,017.

Climate: Average temperature, winter 47°, summer 72°; summer nights always pleasantly cool.

Annual rainfall, about 60 inches.

Lands: 100,000 acres of tillable land; over 500,000 acres of timber land, uncut; about 30,000 acres of timber land, denuded; 1,000 square miles of grazing land. No waste land.

Hay, 30,000 acres; oats, 2,000 acres; barley, 5,000 acres; wheat, 500 acres; rye, 500 acres.

Fruit trees in Sierra County, bearing: Apple, 160 acres; apricot, 2 acres; cherry, 4 acres; peach, 5 acres; pear, 10 acres; plum, 5 acres; almond, $\frac{1}{2}$ acre; walnuts, 1 acre; small fruits, 10 acres.

Price of land, from $5 up.

Character of agricultural soil: Black loam, very rich.

The principal towns and their population are as follows: Downieville, 500; Forest City, 400; Sierraville, 250; Loyalton, 500; Sierra City, 400.

Tax rate (county), $2.52.

The natural products consist of gold, sugar pine, white and yellow pine, fir, spruce, and cedar timber; livestock of all kinds; fruit, berries, and garden truck.

Manufactured products: All kinds of lumber, boxes, sashes, doors, etc., creamery butter.

Other possible products are iron, copper, asbestos, lime, nuts.

Products shipped in 1901: 500 carloads of lumber, boxes, etc., from Loyalton, 200 carloads of beef cattle, 100 carloads of sheep, 10 carloads of creamery butter.

Minerals in county: Gold, iron, copper, asbestos, and lime.

Irrigation facilities are unlimited.

Power facilities are unlimited.

Wages average about $65 per month.

Transportation facilities: Boca & Loyalton Railroad, Central Pacific Railway, Nevada-California-Oregon Railway, and Hobart-Mills Railroad.

Communication facilities: Sunset Telephone Company, 56 boxes; Western Union Telegraph Company, and Sierra Valley Telegraph Company.

Educational facilities: 23 first-class common and grammar schools.

Health resorts: Campbell's Hot Springs, Webber, Independence, and Gold lakes.

Mineral waters: Campbell's Hot Springs at Sierraville, and Soda Springs at Poker Flat.

Hunting and fishing: Abundant in all parts of the county, trout, mountain quail, grouse, duck, snipe, deer, bear, etc.

SISKIYOU COUNTY.

Siskiyou County is one of the most northerly of the State, being bounded on the north by the Oregon State line; on the west its boundaries are Humboldt and Del Norte counties, on the east Modoc County, and on the south Trinity and Shasta counties. It has an area of 6,078 square miles, or 3,889,920 acres, of which 900 square miles are valley land, the greater part of the remainder being mountainous.

It contains a large area of farming, mining, desert, swamp, and timber lands. The mining section comprises the western and southern sections; the agricultural district lies chiefly in the central portion of the county, while the grazing lands lie along the Oregon border.

TOPOGRAPHY.

Siskiyou is one of the most rugged of California counties. Here the two great ranges—the Sierra Nevada and the Coast Range—meet, forming the head of the great California valley, known in the north as the Sacramento and in the south as the San Joaquin. The Coast Range, under the local names of the Salmon and Siskiyou mountains, are in the western part, while the outlying ranges of the Sierra Nevada are in the southeastern part of the county.

There are few regions of country more rugged and mountainous than that lying to the westward of Scott Valley. The whole wide landscape appears to have been formed by some mighty convulsion of the earth, that has thrown up numerous spurs or broken ranges of mountains to the height of from 7,000 to 9,000 feet, and piled them together in strange confusion. During the winter and early spring months they are covered with an immense fall of snow, that renders them a dreary and desolate waste, uninhabitable to man or beast. The snow, however, rapidly disappears under the bright, warm rays of the summer sun, and by the middle of July it is almost entirely gone, and valley, grove, and glen are robed in a mantle of verdure in which are mingled the choicest of wild flowers. Here and there, in the more elevated spots, the snow lingers in great banks throughout the season, but they only serve as refrigerators to lessen the otherwise oppressive heat of summer time.

In the southern portion of Siskiyou, standing at the head of the Sacramento Valley, rises Mount Shasta, the grandest peak in the State, whose famous height has made this portion of California remarkable to travelers. Mount Shasta is a part of the Coast Range, and is between the two ranges, in the southern part of the county. The mountain is 14,450 feet high, being perpetually hooded with snow. The valleys here are from 2,000 to 4,000 feet above the sea-level, the mountains all being among the highest in the United States. The Coast Range is, indeed, at its most picturesque in Siskiyou County, the summits being very unlike the rounded hills surrounding the bay of San Francisco, for they rise, with their rocky formations of granite and slate, into rugged and precipitous peaks. The Sierras also consist in great part, in Siskiyou, of rough and rugged buttes, much of the county thus comprising cañons, gorges, ravines, abrupt mountain walls, precipices, and sudden little valleys. Fortunately for the material interests of the county, this wild country is covered with magnificent forests of redwood, fir, and sugar pine, while the valleys and level lands along the rivers are all extremely fertile.

In the northeastern part of the county lie lava beds, although the "lava beds" proper, of local Indian depredation history, are across the State line to the north. All of the country, in fact, in this northeastern portion of the State, embracing Siskiyou, Modoc, and Lassen counties, is a high plateau, part of which is called the Central Basin, having beds of lava divided by volcanic peaks. This plateau is from 3,500 to 4,000 feet above sea-level, having steep mountains rising still 10,000 feet higher. This whole table-land would seem to have been formed by some great volcanic overflow of a former period of history.

WATER-SUPPLY.

The principal river is the Klamath, which runs from the Klamath Lakes, at the Oregon boundary, across the country and down through portions of Del Norte and Humboldt counties, its watershed extending from Mount Shasta and the Trinity range on the east, to the Siskiyou and Coast Range on the west, into which flows the Shasta, Scott, Trinity, and Salmon rivers on the east side, and numerous small tributaries from both sides. The Sacramento River also rises in the southeastern portion of this county, near the headwaters of the Trinity, Scott, and Shasta rivers. Most of the McCloud River, a tributary of the Sacramento, is also in the county. At the Oregon boundary, Little Klamath Lake, some 20 miles in length, is mostly in this county, connected by Link River with the Big Klamath Lake in Oregon, which is over 40 miles long.

VALLEY LANDS.

The largest valleys in the county are the Scott, Big and Little Shasta, and Butte Creek valleys. Scott Valley is the most fertile of any, and is 25 miles long by from 3 to 5 miles wide. Big Shasta Valley is still larger, but is used most extensively for stock-raising, while Little Shasta is one of the richest farming sections of the coast, although not over half as large as those first named. Butte Creek Valley lies east of Little Shasta, and extends along the Oregon line from the high ridges of Klamath River to the famous lava beds. This valley has heretofore been used mainly as a stock range, but settlers are now coming in and taking up farms. Along Cottonwood and Willow creeks good farms and orchards yield fair returns, and on the mountains surrounding good feed for stock is afforded, while the gulches are excellent places for planting vineyards. Strawberry Valley is south of Big Shasta, at the base of Mount Shasta, and is a splendid section for the production of superior mountain grass for dairying. Squaw Valley, on McCloud River, farther south, is also well adapted for this purpose. The traveler along the main thoroughfares of Little Shasta Valley is favorably impressed with the number of comfortable farm houses and immense grain and hay ranches to be seen on every hand. Little Shasta River supplies an abundance of water for irrigating the whole valley, and, as a result, the latter is beautiful to behold.

SOILS.

The soil of Siskiyou County differs greatly in different portions. In the valleys it consists largely of a deep, black loam, merging to a sharp granitic character in the foothills. The large amount of eruptive rock that covers the northeastern part of the State of California, and which has had its source, to a great extent, in Mounts Lassen and Shasta, extends over the north and east portions of Siskiyou County, covering an area of over thirty townships, known as the lava beds district. Mount Shasta itself is situated on the western boundary of this immense lava flow, near the southern boundary of the county, and rises out of the plain a solitary cone 14,450 feet high, forming a prominent and picturesque landmark; it is entirely volcanic.

MOUNTAIN RANGES.

Passing through the center of the county, coursing somewhat west of north, with a granitic axis, is the range of Scott Mountains, with Scott Peak, 7,800 feet high, near the boundary of Trinity County. This range is flanked by micaceous and other slates, greatly contorted, and traversed by quartz veins, dipping southwest. This granite extends northwest in a belt about 4 miles wide, where the Klamath River crosses it, 9 miles below the mouth of Scott River, and connects with the Siskiyou Mountains in the northwest corner of the county. The Siskiyou Mountains form the divide between Del Norte and this county, and are a rugged, granitic range towering up into separate peaks deeply furrowed. All the streams coming from the north show exclusively granitic bowlders, and evidences of heavy denudations are very apparent where the two counties join the Oregon State line.

Along the southwest border the Salmon Mountains show a continuation of the auriferous slate formation coming up from the southeast, dipping to the west, and in this range we find some excellent quartz mining properties.

CLIMATE.

The climate is more like that of the Middle States, but not so severe in winter; the weather in summer is warm with cool nights. The snow falls on the mountains to a great depth, and in the valleys from 12 to 30 inches, and remains on the ground from eight to ten weeks. At Fort Jones the mean annual temperature is 48.09°; the highest, 94°; the lowest, 4° below zero. The winter is mild, with but little frost, and the high altitude renders the summer delightful, with cool and pleasant evenings. The average temperature in winter is about 40°, and in summer about 65°. Siskiyou seldom has more than a few inches of snow in the valleys, which melts away in a day or two; but the high mountains are covered with considerable snow, which affords a good fountain for summer benefit, in supplying an abundance of water for mining and agricultural purposes.

Good crops of cereals are sure every season on both high and bottom lands, with late spring rains and occasional summer showers, which render irrigation unnecessary during most years. Fruit and vegetables of a temperate climate also grow luxuriantly, and are of the finest quality. The mountain meadows and hills also produce the most nutritious grasses for cattle, horses, and sheep, while all the various ravines and gulches are well adapted for gardening and vine-growing by reason of their shelter among the hills.

FRUIT CULTURE.

Horticulture in Siskiyou County is as yet in its infancy. Until the advent of the railroad a few years ago, there was no market to which the fruit could be shipped. Apples, pears, peaches, plums, and cherries all do well, and are of a size, quality, and flavor not to be excelled by any other mountain county in the State. Throughout the Scott Valley and Big and Little Shasta valleys a large acreage of apples has been set out. The Yellow Newtown Pippin, Winesap, Spitzenberg, Northern Spy, and Winter Pearmain, as well as the Baldwin, are the varieties which do the best.

All along the Klamath River there are favored spots where are produced the finest varieties of apples, pears, peaches, plums, and cherries, while such small fruits as blackberries, strawberries, raspberries, gooseberries, and currants are produced in great abundance. That the fruit interests of Siskiyou County will vastly increase the wealth of the people is a foregone conclusion.

The chief sections in which orchards are found in Siskiyou are Scott Valley, Little Shasta Valley, Cottonwood, and along the Klamath River. Scott Valley is the best fruit section of the county, but as it is situated about 30 miles from a railroad, little of the output finds its way to market. The varieties in favor there are apples, pears, prunes, cherries, and the more hardy fruits generally. These are generally marketed green, all that are not consumed locally being shipped to San Francisco, Oregon, Washington, Montana, and Idaho. Some of the best apples which find their way to the San Francisco markets are those from Siskiyou County.

OTHER INDUSTRIES.

Scott Valley is one of the largest valleys in the county and mostly devoted to the raising of agricultural products. Dairying is one of the chief industries; there are several up-to-date creameries with skimming stations attached, and several cheese factories, located throughout the valley. The class of cattle is of a very high grade; considerable numbers of beef cattle are fattened during the season and shipped to outside markets. Cereals of all kinds do well, and hay and vegetables are raised in large quantities. Hogs and poultry are raised in considerable numbers, and are valuable and growing industries. Failure of crops is unknown in this valley.

Many promising quartz and placer mines are being worked in this locality.

Shasta Valley is the largest valley in the county, and diversified farming is successfully carried on therein. Cereals of all kinds, and hay, are raised. Dairying and apple-growing are quite prominent and profitable industries. The apple grows to perfection in this section. Much new land is coming under cultivation.

Butte Creek Valley is the center of the cattle-raising and grazing industry, its ranges affording the finest of natural feed.

Gazelle is the largest shipping point in the county, and during 1901 over 12,000 head of cattle were shipped to outside markets from this point alone.

The famous Klamath Hot Springs, one of the best known health resorts of California, is located in this county.

Lumbering is the most valuable industry, and the most extensive forests of sugar pine in the State are located in Siskiyou County. The value of the output of pine lumber in 1901 was close to $2,000,000. Many sawmills are in operation.

The mining industry is a very profitable one. Quartz, placer, and hydraulic mines are located in different sections of the county. The gold product of the county in 1901 was close to $1,000,000. Copper in large bodies exists, as well as deposits of iron, cinnabar, asbestos, etc. The mineral wealth of the county is almost inexhaustible.

Yreka is the county seat, and is connected by a branch road with the main line of the California & Oregon Railroad at Montague. The population is very close to 1,500.

There is a large quantity of vacant land throughout the county. The last report of the United States General Land Office gives the area of unoccupied lands as over 2,000,000 acres, chiefly timber, grazing, farming, and mineral.

SOLANO COUNTY.

Solano County has a position about midway between the northern and southern extremities of the State of California, and 22 miles north of San Francisco. Its boundaries are mainly natural, having the Rio de Los Putos (commonly called Putah Creek) on the north; the Sacramento River, Suisun and San Pablo bays, and the Straits of Carquinez on the south; the Sacramento River and Yolo County on the east, and San Pablo Bay, the summit divide of the Suscol Hills, and Blue Mountains on the west. It is not exactly square, but about 40 miles from north to south, and averaging almost as much east and west. It contains an area of 828 square miles, or 530,000 acres.

TOPOGRAPHY.

Swamp lands border the Sacramento River in the southeasterly part of the county, and Suisun Bay on the south boundary, with San Pablo Bay on the southwest, and are overflowed a few inches in depth at ordinary high tides. In the southeastern portion of the county are the Montezuma Hills, rising from 50 to 300 feet above tide water, and intersected by narrow ravines or hollows, the watershed having an easterly and southerly trend. The Townsend Hills, in the southwestern portion of the county, are of a familiar character. Occupying about twelve sections of land are the Potrero Hills; and in Suisun township, Robinson Island rises out of the tules, and contains about a quarter section of land.

A very large portion of Solano County—at least two thirds of it—is valley land, the remainder being properly described as foothill. A spur of rolling hills extends from Vacaville nearly north to Putah Creek, averaging 3 miles in width, the slopes and smaller valleys of which have become noted for their early production of fruit and vegetables. On the west of these hills, and parallel to them, lies Pleasant Valley, extending to Putah Creek. The crest of the Vaca Mountains forms the boundary line between Napa and Solano counties. These mountains reach their highest elevation in Blue Mountain, which is 2,000 feet above ocean-level.

CLIMATE.

The climatic conditions of Solano are very much like those of her sister counties, although varying much with location. The southern portion, lying on the bay, has many of the climatic features of San Francisco, modified greatly by its remoteness from the Pacific Ocean, while in the northern and eastern portions, situated farther inland, the Sacramento Valley climate is found. The summers here are long and the weather usually warm, sometimes hot. The winters are usually moderate, occasional frosty mornings are seen, and at rare intervals ice will form; but excepting on days when it is raining, the sky is clear and the weather pleasant.

SOILS.

The soil varies from red gravel to black sandy loam, from barren patches of alkali to rich alluvium; in fact, within the borders of Solano all classes of soil may be found. That of the swamp and overflowed lands is largely composed of decayed vegetable matter, admixed with sedimentary deposits brought down from the uplands by streams. The soil in the greater part of the Sacramento Valley is a light sandy loam, especially adapted to tree growth.

In the trough of the Vaca Valley the soil varies from a sandy to a clayey loam, and sometimes to "adobe."

Throughout the hilly land to the east and northeast of Ulattis Creek the soil varies from sandy to clayey, according to the character of the parent formation. Experience has proved that the heavier soils are the best for pears, and the more sandy for peaches and apricots. In wells dug in this district, which may be said to form the western boundary of Vaca Valley, the surface soil varies from 1 to 10 feet in depth, beneath which sandstone, interstratified with shale, has been penetrated in some instances to the depth of over 200 feet.

HORTICULTURE.

Solano County ranks among the leading horticultural counties of California, and during the past ten years has made wonderful strides in this direction. In climate and soil, Solano seems eminently qualified for horticultural pursuits, and the earliness and superiority of her fruit products have given her not only a State but also a national reputation. It is in Solano County that the celebrated Vaca Valley is found, the fruit and vegetables from which ripen and find their way to market so much in advance of that grown in most sections of the State. This valley is about 12 miles long and 2 miles wide, and owes its advantages to elevation, location, and surroundings—the surrounding hills protecting it from chilling winds, and the slopes giving to it the full benefit of the spring sunshine, while the deep, rich, fertile soil gives all the required constituents for plant life. Of the 20,000 acres in fruit in this valley, the bulk is devoted to the peach, apricot, and grape. The pear, cherry, and prune are also favorite fruits, while oranges have done well. The income of the valley from fruit annually amounts in round numbers to $1,000,000. Trains leave daily during the season for the East loaded with fruits.

The extreme earliness with which fruits ripen in the Vaca and Pleasant valleys is attested by the fact that cherries are shipped regularly by the first of April, and apricots early in May, with all other fruits proportionately early. Vegetables are grown, too, in large quantities, and find a ready sale in the San Francisco market because of their early maturity. The advantage which is thus derived is certainly very great, and the high prices received by the fruit-growers in this section attest the esteem in which their products are held by the public, both in California and the East.

Over the whole county are found numerous orchards of various kinds of fruits, all of which do remarkably well and amply reward their owners for the labor expended upon them.

The chief fruit sections of Solano County are Suisun, Vacaville, and Laguna, and the principal varieties of fruits grown there are apricots, peaches, pears, plums, prunes, and table grapes. Vaca Valley is renowned for its early productions of fruits, all varieties ripening there from ten days to three weeks earlier than in most other sections of the State. On this account the land is very largely devoted to the growing of fruit, and especially for Eastern and San Francisco markets. A very large proportion of the fruit is shipped green for table use. In addition to that exported, large quantities of fruit in Solano County are canned and dried.

ACREAGE SOWN.

The latest Assessor's returns give the following acreage: 93,000 in wheat, 800 in oats, 41,730 in barley, 290 in flax, 2,750 in sugar-beets.

LIVESTOCK AND DAIRYING.

The livestock and dairying interests are both considerable and profitable. The County Assessor's report shows the following values for livestock: Sheep, $50,000; cattle, $202,000; horses, $52,000; mules, $61,000; hogs, $10,580.

Poultry interests are quite large and are increasing. A profitable field is open to this industry.

The following special article is from "The Bee Annual" of 1902:

"Some years ago, in a contest to determine which county of Northern and Central California enjoyed supremacy in the variety of its products, the award of a golden cup worth $5,000, offered at the Midwinter Fair to the most representative county, was made to Solano County. The longer the lapse of time, the more it becomes apparent that the choice was a wise one and that from the soil of this mid-California county can be drawn every product which marks California's preëminence.

"Solano County lies between San Francisco and Sacramento, on the line of the Southern Pacific. To the traveler it is best known by its miles of green tule lands, spotted by herds of cattle, if it be spring, and the home of seemingly countless thousands of ducks and geese, if it be the late fall or winter. But when the course of the Sacramento is followed after Suisun Bay has been traversed, it will be found that contiguous to the tule area devoted to cattle-raising and the paradise of the hunter of geese or ducks of every variety, including the highly esteemed canvasback, there is an upland which, as a wheat area, is in no sense inferior to any in the State, but which has one advantage denied to many other localities by reason of its contiguity to cheap lines of communication with the warehouses lining the Straits of Carquinez.

"The tule land itself is but the richest soil in process of slow formation, and throughout its broad area, particularly along its border, may be found some of the best dairying sections of the State. But in the wheat ranches of the Montezuma Hills may be found a part of the 45,000 acres which go to make up eastern Solano, and which are about evenly divided into lowland and upland. Here the yield is large and the production certain. Land is low in price, compared with its productive capacity, and offers the certainty of an annual production of 56 bushels of wheat to the acre, 75 bushels of barley, a staple crop of 35 bushels of beans, and potatoes running from 75 to 200 sacks. All of this section, adjacent to the river, has a freight rate of 70 cents a ton.

"Beginning at Carquinez Straits, the voyager will see evidences of the fisheries which add to the wealth of the county. As the train leaves the straits by Army Point, back of which is situated the Benicia United States Arsenal and a four-company post, the triangular sails of the fishing fleet may be observed and their course followed until the county boundary is traversed. Salmon canneries dot the bay and swell the wealth drawn from the soil. The growing of grain is being supplemented by the successful cultivation of hemp and flax, while fruits, particularly grapes, do well. The soil is rich and practically inexhaustible. A good deal of it is adobe, which can be cropped with no apparent lessening of fertility.

"The center of this region of fertility is Rio Vista, an enterprising town of about a thousand inhabitants. It has a large trade with the adjacent islands, and is backed by a rich area of profitably-farmed land. The town has recently sold $20,000 in bonds for the purchase of a water system, and is a growing and thriving community. It has good schools and provides for the higher education of the young by St. Gertrude's Academy, where the young of both sexes secure a thorough and beneficial training. Rio Vista is a progressive town and its future is marked by an assurance of an ever-increasing prosperity.

"To the west from the line of the Southern Pacific lie Green Valley and the portion of Suisun township devoted to fruit. Green Valley is an agricultural section which was among the first to attract settlers. It has been devoted to vineyards for many years. Portions have recently been planted successfully to sugar-beets. Cordelia is the metropolis of Green Valley township, and is supported by extensive quarries, where basalt blocks for neighboring cities are fashioned. It has several wineries and enjoys an excellent reputation for their products. It has a large acreage in fruit, although usually not of the early varieties.

"Solano County is unfortunate in that its railroad lines, like the Union Pacific, traverse in great part the most uninviting portion of its territory. Looking toward the hills which divide Suisun township from Napa County, there is hardly a suggestion of the area devoted to fruit or the matchless character of its orchards. Large fruit-houses are seen, however, which are engaged in the shipment of green fruits, and the handling of the dried products of the ranch by the hundreds of tons. Necessarily all of these great packing and exporting houses employ a large number of men and women to handle the fruit in the various stages of its preparation for the East, or for Europe, where a large part of it is shipped.

"But to appreciate the capacity of Suisun Valley, a visit should be made to this notable section. It does not boast of its early fruits, but it has one of the largest orchards in California, and through every acre of its orchards it gives evidence of the careful character of husbandry practiced in the locality in the trimness of its orchards, and its generally attractive appearance. From this portion of the county there are shipped nearly five hundred carloads of fruit, comprising cherries and other varieties, but composed in the largest degree of pears, for which the valley is particularly well known. Land in Suisun Valley is high when purchasable, but it is low in proportion to income returned and will pay dividends on any price at which it has ever yet been quoted.

"Suisun is the center of this section and also for a large portion which extends east through Denverton township and meets the portion comprised in eastern Solano. It is devoted largely to grain-growing and cattle-raising and is also used extensively for sheep pastures, which have been profitable and have been the means of building up several large fortunes for those engaged in it. It has the advantage of cheap communication with San Francisco by means of Suisun Slough, which assures a low freight rate without any appeal to the Board of Railroad Commissioners. The enterprising people of Suisun have recently organized a company and will construct a boat to do a freight business between that point and the city, at rates with which the railroad will not compete. Suisun is the point from which freight is scattered throughout the entire northern portion of Solano County, and does a business vastly disproportionate to its size. Teams haul freight daily in competition with the railroad as far as Vacaville, ten miles to the north. The county seat, which is located at Fairfield, just north of Suisun, and separated from it diagonally by the railroad, does not contain a court-house which is an architectural attraction. But it does, ''tis enough, 'twill serve,' while the county owes no debt, and taxation is limited by reason and a proper care of roads and highways on lines of permanence.

"In the center of the county, stretching to the river lands on the east, is a low country devoted to sheep, cattle, and barley. Frequently during the winter it is under water. But farming is profitable in Denverton and throughout Maine Prairie townships, and they are the resorts of hundreds, who find their bags of game only limited by the capacity of an ox team. In the northeast corner of the county lies Tremont township. To the south and east it is devoted to grain and cattle. Along the north boundary of the county in this township may be found some of the best lands devoted to grain-farming or fruit. In fact, lying along the south bank of Putah Creek, which forms the division line of the county on the north, is a section of land which for fertility can not be surpassed. It is early, too, and is being rapidly cut up into orchards which are probable sources of profit to proprietors.

"The area devoted to fruit for a considerable period begins somewhere east of the line of the Vaca Valley and Clear Lake branch of the Southern Pacific, and extends westward to the mouth of Putah Creek Cañon, and south through Vacaville township and includes the western portion of Elmira. But what has been done in Vacaville township in the line of a transformation of a wheat section to fruit growing, is being repeated successfully in Silveyville township. There are no high-priced lands there, but there are no better lands in the State. Like a large portion of Vacaville township, it was a part of the Vaca and Pena grant of 44,000 acres made in 1844, and was doubtless selected on account of its surpassing fertility.

"At the easterly end this strip along the creek was devoted to raisin grapes long before Fresno was on the map, and its vineyards are no less productive than in the past. Every foot of this section is good land and is capable of supporting a population of thousands. It is good territory for grain, of course. Its demonstrated value for fruits is equally certain, while such acreage as has been planted in sugar-beets shows a product unusually high in percentage of saccharine matter.

"Sweeping south from the creek there is a gentle slope to the east, but no change in the fertility of the soil. Silveyville township is rich by nature's gifts and by the accumulations of her people. It is not every locality which can boast millionaires whose lives have been devoted to wheat-growing, but they can be found in Silveyville township. Recently a creamery has been built at Dixon, the center of the township's population. It is a source of profit and is awakening the minds of the people to the value of a more intensive farming and the diminution of the average ranch area. The creamery in Dixon is telling the old story of the little farm well tilled, and is certain to be the pioneer of numerous similar profitable enterprises. Dixon is a town of wealth and conservatism. But there is a spirit of enterprise pervading its people, and the changes which are promised in that favored locality will be markedly beneficial, both as to an increase of profits and of population.

"All of northern Solano can be irrigated. Little of it is. The waters of Putah Creek are practically unutilized. Away to the north is Clear Lake with 52 square miles of water ten feet deep, only waiting the application of capital to one of the most feasible schemes of irrigation within the knowledge of those who have given matters of this kind consideration. But while the flood waters of the mountains run unchecked to the sea, the process of wresting the farm from the ranch is going on. Pumping plants are being installed on ranches contiguous to Dixon, and more money is being made off tracts of limited area than was secured from a broad expanse of acres. Dixon has started upon a new career, in which she invites the people of the East. There they will find all of the conditions demanded by a consideration of an avocation where health is assured, and rich rewards wait on industry.

"Between Dixon and Vacaville lies Elmira. It is a small town, but the center of a broad expanse of acreage, devoted to cattle-growing, wheat-raising, and diversified industry. There are a good many in this section who surpass the profits of the wheat ranch by the income secured by the housewife in attending to the needs of poultry, or the dairy, as a means of supplementing income. Its climate is delightful. A little warmer than Suisun, which is a modified temperature of the purely bay area, and a little less warm than Dixon, in Silveyville township, to the north, or Vacaville to the west, any part of Elmira will be found profitable in any branch of agriculture.

"Vacaville is pretty well known. Its fame seems to have spread abroad. Walter T. Swingle, of the United States Agricultural Department, on returning from Africa, in connection with the Government importation of the date palms to be planted along the Colorado River, learned at Paris that in Vacaville the date palm flourished, and visited the place for the purpose of its examination. Along the south bank of Putah Creek, and in a section tributary to Winters, the shipping point just across the creek, is the old Wolfskill homestead. Here some forty years ago the proprietor of the Wolfskill grant planted the seeds of dates bought for his children. In a frostless area they grew unchecked, and near the house of Colonel Sam Taylor this purely tropical product—which demands that it plant its feet in the fountain, while its top revels in the furnace of a Sahara sun—can be found annually maturing its fruit. Date palms are not infrequent in California, but it appeared that, unless the Government experiments along the Colorado are a success, it is the only fruit-producing date tree in the State. In citrus culture the same tropical character is found. In Vacaville and in Silveyville township there are citrus groves aggregating forty acres in extent. That more oranges have not been planted is due to the fact that deciduous fruit-growing has been found sufficiently profitable to suit the most exacting. Oranges may be grown in these sections in any quantity and placed in the San Francisco or Eastern markets ahead of the products of Los Angeles or Riverside. The quality of earliness is not confined to deciduous fruits, but embraces the citrus varieties as well. The county took a premium for oranges at the Midwinter Fair, held in 1894, and can match from its groves the best product of any part of California.

"No stronger tribute could be offered to the tropical character of the northern portion of Solano. It might, however, be supplemented by the shipment of cherries from Vacaville on March 31, during two seasons, and an annual and certain production of the earliest cherries grown in California, as well as the first apricots, peaches, and other varieties. It is equally early in the production of vegetables, and holds the San Francisco market with its early products for weeks, to the exclusion of all other localities. It is a large shipper of green and dried fruits, and in 1901 shipped 821 carloads of green fruit, and enough dried to make the total 950 carloads out of Vacaville during the season. Out of the 1,400 carloads of fruit shipped from Solano County last year, six tenths were from Vacaville, three tenths from Suisun, and the other tenth from the fertile strip along Putah Creek.

"In manufacturing, Solano County is prominent with the location of the navy yard at Mare Island, opposite Vallejo. In Benicia, however, in addition to the Government arsenal, there is an extensive manufactory of agricultural implements, which ships its products to every portion of the world, and furnishes employment for a large number of hands; also extensive tanneries which are continually being enlarged, as they find an ever-widening demand for their products. The Bay Counties power line, which traverses Solano County transversely from the northeast to the southwest, furnishes Dixon, Elmira, Vacaville, Suisun, Fairfield, Cordelia, Benicia, and Vallejo, a potentiality that surpasses Holyoke or Fall River as manufacturing centers. It is being taken advantage of north of Suisun by an extensive plant for making cement. A company is expending a quarter million of dollars in improvements, which promise to add much to the wealth of Solano County. Benicia is a former State capital, as was Vallejo, has a population of several thousand, a climate that is cool and exhilarating, and is an attractive residence location tributary to San Francisco.

"Vallejo is the metropolis of the county. It is a money city. Every month in the year $100,000 in gold coin comes in for circulation among its people. It is a progressive city. Its people are up and doing. They have abundant faith in public utilities, and they practice them as well. The spirit of self-reliance predominates. It is coming to be a city of homes. Located on a magnificent waterway, and built on hills that lend grandeur to the view; with a climate that is balmy with the rigor of sea air, equable in its character, and practically free from fogs, Vallejo is an ideal residence city. There is an air of stability in its physical make-up. Ever since the Mare Island Navy Yard, its chief dependence, employing from 1,500 to 2,000 men, was taken from a political, and placed upon a civil service basis, thus insuring retention of employés regardless of changes in National administrations, Vallejo has been advancing. One good thing has led to another as the result of this policy, and not the least meritorious was the confidence it gave the people to engage in business for themselves. As we have already stated, Vallejo is a firm believer in public utilities. It owns and operates its own water works, that yield a revenue of $36,000 annually, at an operating cost of less than $5,000.

The system is a gravitation one, the water being brought to the city from the mountains, 15 miles distant in a direct line. No city in the State has better results or better water than has Vallejo. These water works have been owned by the city since 1894. In the meantime, the city has constructed a most perfect sewer system, put down substantial sidewalks, has a mile of bitumenized streets, with more to follow, and has many hundreds of new and modern cottages that make the city attractive. It is, in fact, a city of industry and enterprise. Its latest move is to secure the construction of electric railroads, that are to connect Benicia, in this county, and Napa and St. Helena, in Napa County. Within the year just passed five franchises have been secured, at the cost of considerable labor and money, and capital is under a written contract to construct the road. A few miles north of Vallejo a corporation has been formed to develop a cement deposit that is superior in quality to the famous Portland, and endless in quantity. The company is capitalized for $2,000,000, and many thousands of dollars are already invested in the enterprise. Three miles northeast of the town the old St. John quicksilver mine is being reopened at a cost of thousands of dollars. In the early 70's this mine yielded $500,000, and was closed down in the face of high-grade ore, because of over-production and consequent low price of quicksilver. The population of Vallejo now approximates 10,000. The great increase has made necessary additional school accommodations, and new buildings are to be constructed. At the city election, in March last, its people voted, by ten to one, in favor of the issuance of $90,000 in bonds, to be used in enlarging the delivery capacity of its water works system, the rapid growth in the number of consumers—from 1,100, in 1894, to 2,000, in 1901—having made this step an absolute necessity. It enjoys the advantages of a splendid high school, and its schools have a magnificent corps of teachers. It has the free postal delivery system; a splendid public library; a well-organized fire department; owns and controls a public wharf, which is not only an ornament, but a source of revenue to the city; has day and night electric service; has a women's improvement club of two hundred active members; has forty-four fraternal orders and societies, and has a great future. It is a city closely in touch with San Francisco; three steamer lines engaged in freight traffic; one steamer line making three round trips daily, built like a yacht, and fast as a torpedo-boat, doing a splendid passenger business, as well as that done via railroad, with round-trip fares ranging from 50 cents to $1.50. In addition to these evidences of a progressive city, it has a flouring mill and warehouse, tannery, salmon cannery, planing mills, etc., giving employment to hundreds of hands. The opportunities for the profitable investment of capital are not excelled by any other place. The conditions are ripe for a modern opera-house, an up-to-date hotel, and business blocks as well. In some respects the city is lacking in these things, and the capital first on the ground to take advantage of them will profit. In the last year an active Chamber of Commerce has made the subject of ship-building in navy yards a material issue, and ten thousand labor councils have petitioned Congress to utilize its navy yards to the utmost as public utilities. The large plant at Mare Island is being vastly improved, and is to-day equipped with the finest machinery for the construction of men-of-war. A new dock, larger than the present one, is now being built, to cost $1,250,000. The future of Vallejo, as a business and as a residence place, is aglow with hopeful signs, and its people are happy, united, and prosperous."

SONOMA COUNTY.

Furnished by the BOARD OF SUPERVISORS and S. A. LUCE, Secretary of the Board of Trade.

Sonoma County is bounded on the south by San Pablo Bay and Marin County, on the east by Lake and Napa counties, on the north by Mendocino County, and on the west by the Pacific Ocean. Its Napa, Mendocino, and Marin boundaries are straight, but its ocean boundary, of more than 65 miles, conforms to the irregularities of the shore. It has an area of 1,500 square miles, or 972,000 acres. On the bay shore it has a frontage of 20 miles.

There is no sameness in the surface of Sonoma County. Variety is a leading characteristic of every township. Valleys, and hills, and mountains appear to have been planned, and their distribution so ordered as to give the best effect. The great central valley, extending entirely across the county from south to north, and having a varying width of from 6 to 15 miles, commands attention by its area and remarkable fertility. The coast range of hills breaks the monotony of the landscape in that direction, while to the southeast Sonoma Mountain rises to the height of 2,400 feet, with Bennett Peak and Mounts Taylor and Hood farther north. Away to the northeast Geyser Peak has an elevation of 3,740 feet, and from its greater height, just beyond, St. Helena looks down upon the whole of Sonoma County. And these hills and mountains are not for ornament alone. High up on their fertile slopes, yes, even upon their very summits, are numbers of the finest homesteads in this county. The area on which rough stone is found to interfere with general farming operations is quite small. Out of the immense area of land in Sonoma County, at least 200,000 acres are valley land, the richest soil known, being a black loam; 200,000 acres are rolling or higher tableland, with an exceedingly rich alluvial brown soil, with considerable sand. This, as a rule, is the best fruit land. We may class 200,000 acres as foothill lands, adapted to many kinds of agricultural and horticultural products and pasturage. At least 100,000 acres of mountain land are adapted to grazing, and about 80,000 acres are redwood timber lands of the most magnificent growth to be found anywhere.

LOCATION.

The location of Sonoma County is a matter to which we would call particular attention. As comparatively few Eastern people have a map of California in which the counties are designated, we will endeavor to locate it with respect to its relative position to and distance from such important points as generally appear on all maps. Distances are reckoned from the county seat, Santa Rosa, which is centrally situated. It is 48 miles north of San Francisco, the great metropolis of the Pacific Coast; 68 miles due west of Sacramento, the capital of the State; 400 miles northwest of Los Angeles; 300 miles south of the northern boundary of the State, and comes within 50 miles of being the farthest western point of the western coast of the United States, except Alaska. The southern boundary of the county fronts on San Pablo Bay, an arm of San Francisco Bay, about 30 miles north of San Francisco. It is 350 miles farther west than San Diego, and 280 miles farther west than Los Angeles. On the west it has a coast line of 60 miles, and has several small but valuable harbors, bays, and beaches of its own.

VALLEYS AND WATERCOURSES.

Sonoma Valley, from which the county derives its name, is about 20 miles in length, with an average width of 8 miles. It lies parallel to Petaluma Valley, from which it is separated by a range of mountains.

The streams and watercourses of Sonoma County are numerous, and might, if it were necessary, be utilized for irrigation. On the coast frontage streams of greater or less size flow down from the adjacent hills, at short intervals, to the sea.

Russian River, the largest stream in the county, enters on the north, flows in a southeasterly direction for 20 miles, turns Fitch Mountain, and finds its way to the lowest depression in the Santa Rosa basin, from which it breaks through a gap in the Coast Range to the Pacific Ocean. This river gathers the waters from three fifths of the area of the county. Its largest tributary on the northeast is Dry Creek, flowing out of the Coast Range through a splendidly fertile valley 20 miles long and 2 or 3 miles wide, running parallel with and merging into the central valley at the point where Dry Creek delivers its waters to Russian River.

From the northeast, the largest tributaries of the Russian River are Sulphur Creek, upon which the celebrated Geyser Springs are located, and McDonald Creek, which flows through and out of St. Helena Valley into Russian River. From the mountains on the east, Mark West and Santa Rosa creeks come down to the plain, and flow for 10 miles across it parallel with each other and 4 miles apart. They empty into the laguna or lake of Santa Rosa, which overflows at high water into Russian River. Copeland Creek comes into the valley from the south, flows northerly, and also empties into Santa Rosa Laguna.

RAINFALL.

A fair estimate of the rainfall throughout the county may be formed from the record here presented. The observations were made at Santa Rosa. As Santa Rosa is centrally located and is not subject to weather conditions appreciably differing from those in other portions of the county, the record may be considered as fairly representative of the whole. The table shows the rainfall during the growing season, commencing the year previous with the month of September, and ending with June of the year named.

Year.	Inches.	Year.	Inches.	Year.	Inches.	Year.	Inches.
1854	29.00	1866	28.00	1878	44.65	1890	65.75
1855	30.00	1867	40.00	1879	31.56	1891	21.45
1856	25.00	1868	50.00	1880	31.16	1892	28.83
1857	25.00	1869	26.00	1881	34.22	1893	34.07
1858	23.00	1870	25.00	1882	17.38	1894	27.16
1859	34.50	1871	17.00	1883	24.45	1895	45.81
1860	21.00	1872	40.00	1884	20.40	1896	31.48
1861	17.00	1873	21.56	1885	15.32	1897	31.48
1862	46.00	1874	29.54	1886	37.24	1898	18.74
1863	17.00	1875	23.30	1887	19.64	1899	23.04
1864	12.00	1876	34.55	1888	20.97	1900	28.83
1865	26.00	1877	15.25	1889	25.99	1901	30.69

POULTRY INDUSTRY.

It may seem a broad assertion, but nevertheless it is true, that Sonoma County, together with her great wine, fruit, dairy, stock, and other large industries, produces as much poultry and eggs as all the balance of the State put together.

The annual output of this commodity is upward of $2,000,000 in value. The advantages of the poultry and egg industry in Sonoma County are, its nearness to a reliable market, quick cash returns, and length of season.

The lower portion of the county, in the vicinity of Petaluma, is largely devoted to this industry; possibly one half of the poultry and eggs that are shipped from the county are shipped from Petaluma. It is stated on good authority that from this point alone 2,600,000 dozen eggs and 20,000 dozen chickens were shipped last year, as high as 14,000 dozen eggs being shipped in one day.

To convey an idea of the profits in the business we quote the following from the Petaluma "Land Journal": "One man near town has 2 acres, keeps 800 hens, and makes $1.25 per hen, clear of expenses. Another, with 20 acres, has banked in three years $3,000, clear of all expenses and living. A few make as high as $1.50 to $2 per hen, and there is no danger of collapse in prices. As proof, note the hundreds of carloads of poultry and eggs imported from the East each year by the commission houses of San Francisco."

The Sotoyome "Sun" says: "Mr. A. B. McMichael has 200 hens, some of which are only pullets. They are mostly White Leghorns and Minorcas, with a few Plymouth Rocks. From this flock he sold during the past three months 600 dozen eggs. The price received for the eggs ranged from 17 to 38 cents per dozen. The total receipts for eggs for the period named was $155.50, or an average of 25¾ cents per dozen."

These are only a few instances among many to which we could refer. With a few acres of land well stocked with chickens a family can make a good, independent living. The poultry business is like the banking business—cash on the spot; and there is no surer road to success than along the chicken route in Sonoma County.

STOCK AND PASTURES.

Cattle are raised here on a large scale, principally for dairying purposes, and the very best breeds are represented. Our grazing land is unsurpassed anywhere. From December 1st to July 1st the pastures are green, being thickly carpeted with the native grasses, alfilaria, white clover, bur clover, wild oats, bunch grass, and many other kinds. Stock will thrive on such ranges the year round without extra feed. In the valley lands it requires about 5 acres per cow per year for dairying purposes; in the hill lands from 10 to 15 acres per cow. According to the Assessor's reports the number of cattle in the county in 1901 was 31,512 head; sheep, 29,844 head; horses, 12,860 head; hogs, 3,500 head. In the northern part of the county sheep-raising forms an important industry. Much of the country in the coast region is devoted to pasturage purposes.

DAIRYING.

Sonoma County is justly proud of her fine dairies. The milch cows are all of a choice, selected breed of cattle, no poor stock being used. Owing to this forward breeding and the further fact that the nutritious grasses that grow in the dairy districts make exceptionally fine feeding ground, the annual product per cow is, on an average, 50 to 100 per cent higher in this and adjoining coast counties than in most any other part of the State. In other words, the average annual production of butter for the whole State is 100 pounds per cow, while in this section the average annual production per cow will run from 150 to 200 pounds.

A conservative estimate places the number of dairy cows in the county at about 27,000 head, that give an annual yield of nearly 5,500,000 pounds of butter, valued at $1,100,000, or an average of about $41 per cow, saying nothing of the cheese produced.

The dairies number from 40 to 250 cows each, the greater number being 100 to 200. Petaluma, Santa Rosa, Bodega, and Valley Ford are the chief places from which dairy produce is shipped. From these points, by rail and water, large shipments are made weekly to San Francisco and other large markets.

For sixty-five miles the western boundary of Sonoma County is washed by the waters of the broad Pacific. The moisture that rises from the ocean is absorbed by the ground, and from this fact the pastures are kept green nearly the year round, making this section the ideal spot for the dairyman and stock-raiser.

The total of all expenses in the actual manufacture of butter is three-fourths of a cent per pound. The breeds of milch cows represented are mostly Jerseys, Holsteins, and Ayrshires, with some strains of Durhams, and fine American breeds. All milk used at the creameries is bought and sold by weight. The average test shows about 4 per cent, or 4 pounds of cream or butter-fat to 100 pounds of milk. In well-managed dairies the yield of butter per cow per annum is from 150 to 200 pounds.

The value of the growth of stock cattle is $10 per head per year, until the limit is reached, and this without other feed than that obtained by grazing upon lands valued at from $5 to $25 per acre.

HOPS.

In the production of this article Sonoma County leads the world. There is no place in this or any other country that can produce the quality equal to a choice Sonoma. Most all other hop-raising sections, outside of a few counties in this State, are subject to crop failures, caused chiefly by vermin, mold, honey-dew, rust, red spider, or severe storms. Such calamities are unheard of in this county. Vermin is the most dangerous enemy to a hop-grower. A crop may be in splendid condition until the time of harvesting, when this pest may sweep over the section and destroy the entire crop. These insects have had thirty-six years in which to make their appearance in Sonoma County. They can not exist here; they require a warm, muggy atmosphere in which to flourish. During our hop harvest we are always favored with bright, sunshiny days. The very best quality of soil—and we have plenty of it here—together with an excellent climate, is required for a successful culture of hops. In New York state hops are seen growing on elevated land, while in Sonoma County the rich, sandy loam of the river and creek bottoms is employed. In the East and Europe the land has been worked out, and for this reason an enormous expense is incurred by the constant use of fertilizers. The Sonoma County grower never has to resort to this. The richness of the soil, together with the adaptable climate, assures the producer an average yield of about 1,800 pounds of dried hops to the acre. This enormous yield makes it possible to place Sonoma's product in the Eastern and European markets for less than the cost of growing the hops there; the average yield there being in the neighborhood of 1,200 pounds to the acre.

In laying out a hopyard two systems are used, the pole and the trellis. In the former the vines are set about 8 feet apart, and trained on poles 9 feet in height. The cost in addition to the value of the land varies from $35 to $50 per acre, according to conditions. This includes everything—roots, poles, and labor. In the trellis system the vines are set about 7 feet apart, and trained on a trellis work of poles and wires, standing from 16 to 18 feet above the surface of the ground. The total cost of this system per acre is from $60 to $75, and when once installed is permanent, there being no further expense attached.

In this county the planting is done from the first of January to the first of April. The crop is harvested from the 25th of August to the 25th of September.

There is no place where hop culture is carried on that can produce from the first year's planting the amount of the dried product per acre that can be raised in Sonoma County. The largest yield ever raised in this county was produced in 1899, the amount being 18,000 bales. At an average of 190 pounds to the bale this would make a total of 3,420,000 pounds. In 1900 the yield fell to 8,000 bales; in 1901 it increased to 15,000 bales. The average cost of placing hops on the market is 8 cents. The average price obtained by the grower is 15 cents, making a profit of 7 cents per pound.

The hop industry in Sonoma County is certainly assuming greater proportions. Other sections are gradually decreasing their acreage, while Sonoma, on the other hand, is gradually increasing her acreage. Most of the hops are shipped to Eastern and European markets, but there is a growing demand for our product in Australia, New Zealand, and the Orient. The adaptability of this county in producing the quantity and quality has for its proof placed the Sonoma County growers, as a whole, on a better financial footing than the growers in any other hop-raising section of the world.

HAY AND GRAIN.

In this Western country hay is grain cut before it is ripe. Sonoma County produces large quantities of wheat, oat, barley, and alfalfa hay, which runs all the way from 1 to 3 tons per acre. It costs from 90 cents to $1 per ton for baling. Good hay can be raised here wherever one can plow. It is harvested in May and June. Hay brings from $9 to $12 per ton. The yield last season was 45,000 tons.

The acreage devoted to the different cereal products in Sonoma County, as reported by the Assessor, is as follows: Wheat, 12,200; oats, 16,240; barley, 3,640; corn, 1,210. The State Agricultural Bureau estimates that the yield, in bushels, was: Wheat, 200,000; oats, 360,000;

barley, 112,500; corn, 52,500. Our soil, taken as a whole, is particularly adapted to oats, which many consider the most profitable of our grain crops. However, wheat, barley, and corn are extensively cultivated in every locality at a splendid profit. All grain is harvested in June and July. Corn is grown mostly on river bottom land, and yields on an average 50 bushels to the acre.

FRUIT-GROWING.

One of the chief industries of Sonoma County is fruit-growing. Last season there were in cultivation 36,360 acres planted to fruit trees, and the increase up to the present time amounts to about 10 per cent. The total number of fruit trees of all kinds in 1901 was 1,276,278. This estimate is made from the Assessor's figures, and 10 per cent should be added to cover numerous small holdings in less than acre lots. The estimated value of a fruit tree from the time it is planted to the time it comes into bearing is $1 per year. The first cost of tree for setting out is from 10 to 15 cents each. The right season for planting in this county is during the months of February and March. While many fruit-driers are operated here, many authorities prefer the sun-drying process, which involves no expense and can always be relied upon. The sun-dried product is also of superior quality and flavor and will bring a correspondingly higher price in the markets.

Peaches.—The peach is a great favorite among fruit-growers, as the trees commence to bear the second year after planting. The soil best suited to them is a sandy loam, and they may be cultivated with equal success either on the hillsides or in the valleys. They are set 20 feet apart, 108 to the acre. After the trees get into bearing and are large enough to hold the fruit, the income will depend principally upon the care bestowed upon them. Peaches of standard size for the market are those that will fill a 2-inch hole. If larger than this they are called "extras," and if smaller, "seconds." The latter are mostly used for drying. In this county this is done in the sun, thus producing a far better quality than is possible by artificial methods. The fruit is harvested in July, August, and September. All varieties of the peach thrive here. The area in cultivation is now about 2,750 acres. In 1901 there were 197,748 trees bearing, and 13,130 non-bearing.

Prunes.—This fruit should have the best quality of soil, for the tree is a heavy bearer and of comparatively short life—about twenty-five years. The trees are set 20 feet apart, 108 trees to the acre, and they come into bearing after five or six years. The crop is picked in October. Last year there were 5,700 acres in bearing prune trees. With 100 trees to the acre, we have 570,000 as the approximate number of prune trees in the county. The yield last season, expressed in the quantity of the dried product shipped, was 700 carloads of an average value of $400 per car of 12 tons each, or a total value of $280,000. There have since been planted an additional 500 acres, an increase of about 10 per cent.

Pears.—The trees are planted about 20 feet apart in a clay subsoil, and bear after five or six years. Harvesting takes place in September, October, and November. The acreage in pears last year was 1,300.

This has since been increased by 50 acres. Four of the largest pear orchards in the county have a combined total of 10,300 trees. The number of pear trees, all told, in the county is 135,000.

Cherries.—The trees begin to bear within five to seven years after planting. They are set 20 feet apart, and do best in a clay subsoil. The fruit ripens in May and June. There are 365 acres now in cultivation. In 1901 there were 40,040 trees in the county.

Apples.—The land best adapted to apples is that having a clay subsoil. The trees are set 25 feet apart, or 76 trees to the acre, and bear within from five to six years after planting. The fruit is harvested in October, November, and December. The number of bearing trees in the county is 161,251; non-bearing trees, 70,270; total, 231,521. At the present time there are over 2,500 acres devoted to apple culture. The finest apple land in the world is found along the northern coast, and sells at from $10 to $20 per acre. The price paid for apples averages somewhere around $10 per ton, although this is often exceeded in the special varieties. The average yield is in the neighborhood of 8 to 10 tons per acre.

Citrus Fruits.—The growing of citrus fruits, though comparatively a recent industry, has gained a strong foothold in this county, and present indications point to a steady increase in acreage during the future. It was first demonstrated that the orange could be successfully grown here by General Vallejo and Nicholas Carriger about thirty years ago, but it has only been within the past six or seven years that the fact has become generally recognized. There are now about 5,500 orange and from 900 to 1,000 lemon trees in the county. Though mostly young, they are thrifty bearers, and the crop increases with each succeeding year. The most popular varieties of oranges are Mediterranean Sweets and Washington Navels. The three best sizes are those going 126, 150, and 176 to the box, and the prices range from $1.50 to $2.50, according to size. The orange season begins early in December and lasts until June. The lemon thrives here as well as the orange. From the time the tree comes into bearing ripe fruit may be picked every month in the year. It is in blossom continuously. The best sizes of lemons are those that run about 300 to the box. Prices range from $2.25 to $3.50. Both orange and lemon trees are set 20 feet apart, or 108 to the acre. They come into bearing after five or six years.

Olives.—While the olive requires a good, well-drained soil, there are many orchards in this county that are planted around the rocky foothills where nothing else can be grown. They are set from 20 to 32 feet apart and come into bearing after five or six years. There were 400 acres in cultivation last year, and 50 more were added this spring. The number of bearing trees is 26,720; of non-bearing trees, 16,540. Olive culture is making rapid strides in Sonoma County. The first olive grove of about 90 trees was planted in 1870, and from the crop was produced the first olive oil in the county. It was awarded a gold medal at the Paris Exposition, and received first premium at the World's Fair in Chicago, 1893. This county now has about 50,000 olive trees of the very best varieties for oil and pickling purposes. The oil produced here has established an excellent reputation and is usually sold ahead of its annual production. Olive oil costs $2 per gallon to manufacture, and sells at from $3.50 to $5 per gallon. Though slow in coming into bearing, the olive tree is a paying and lasting investment. It has a life of thousands of years, and even history does not enable us to determine it accurately, but it is an absolute fact that olive trees mentioned in the Bible are living and bearing fruit at the present time, notably those in the Garden of Gethsemane in Jerusalem. Every man who owns a farm or a house-lot will find the olive tree not only an embellishment to his premises, but profitable as well.

ACREAGE AND VARIETY OF FRUIT IN SONOMA COUNTY.

	Acres.
Apple	3,000
Apricot	200
Cherry	500
Fig	50
Olive	500
Peach	3,500
Prune	6,000
Pear	1,000
Plum	500
Lemon	10
Orange	100
Grape	20,000
Walnut	500
Almond	100
Berries	600

NUTS AND BERRIES.

Walnuts.—A well-known authority states that Sonoma County is the true home of the English walnut. Indeed, there are few places in the world where it can be more successfully cultivated. What it needs is a suitable climate, for experience has demonstrated that the quality of the soil is of little consequence, provided only that it is deep, for the trees have a very long root. They also have widely spreading branches, and must be set 50 feet apart. This will permit of but 16 to the acre, but they are very prolific, and the large returns fully justify the space covered. It is only recently that the walnut has attracted the attention of growers in this county, but now that its possibilities as a money-maker are becoming more widely known the acreage devoted to its cultivation is rapidly increasing and it promises to become one of our great industries. The number of bearing trees is 2,450; non-bearing trees, 2,210. At present there are 500 acres in cultivation. Trees for planting cost usually about 15 cents, and they bear after six or seven years.

Blackberries and Raspberries.—Sonoma is the greatest blackberry county in the State. Last year there were 500 acres in bearing vines, which produced 1,000 tons, or 100 carloads, of first grade fruit. Of raspberries, 250 tons were shipped. The blackberry season begins in the latter part of June and runs into September. Blackberries are raised extensively. Raspberries are harvested in May, June, July, and August.

Dewberries.—There are now 20 acres of Lucretia dewberries. Last year a part of the crop was shipped to Montana and brought 15 cents per pound. The season is from about the 10th of June to the 10th of July.

Gooseberries.—Of this valuable product we raise without difficulty the largest and finest varieties. They often sell as high as $70 per ton. Their season is in May and June.

Strawberries.—We do not ship many strawberries out of the county, most of the supply being used for home consumption, but those raised are of the very best quality. Some varieties are ready for market as early as February. The season extends into November. The raising of strawberries for the market forms an important and profitable industry.

VEGETABLES AND MELONS.

Sonoma County grows vegetables throughout the entire year, and often raises from two to three crops within this time. In the East nearly every farmer has his vegetable garden, but he raises other products in connection with it. In the West every city and village has its professional gardeners who grow nothing else but vegetables, and supply the market with them.

Potatoes are a staple product of this county. They are grown in almost every section, attain a large size, and are of the finest quality.

Asparagus is particularly adapted to our soil and climate, and we ship some of the best that can be found in the markets. It brings from $1.50 to $2.25 per box containing from 40 to 50 pounds. There are great possibilities for an increased acreage in this vegetable. An average crop is from 80 to 100 boxes per acre. The present profits vary from $100 to $300 per acre.

Tomatoes are produced in great quantities for canning. String beans are also grown very extensively for this purpose.

Rhubarb brought from 75 cents to $1 per box of 40 pounds this spring. A greatly increased acreage of this plant may be looked for in the near future.

There were more than 150 acres bearing watermelons last year. The melons were of large size and fine flavor, and were worth $100 per carload. In the San Francisco market they sold as high as $4.50 per dozen.

GRAPES AND WINES.

Sonoma is the largest and most important grape and wine producing county in the State. Her wines are justly famed throughout the world, and took first premium at the Genoa Exhibition in Italy in 1892. A gold medal was awarded at the World's Fair in 1893, and also at the Midwinter Fair in San Francisco in 1894. In order to accommodate the enormous yield of its own section alone, one wine company here recently erected a wine tank, with a capacity of half a million gallons, the largest in the world.

The total area covered by vineyards in the county amounts to 25,000 acres. At $200 per acre (the average value of the vineyard in full bearing) this represents a value of $5,000,000. With an average of 680 vines to the acre, we have the astounding total of 17,000,000 grapevines. The cost of producing a ton of grapes is estimated to be $8. The grape-grower receives from $10 to $20 per ton for his product. Wine grapes yield from 140 to 150 gallons per ton. The price of wine, one year old, ranges from 10 to 20 cents per gallon. Last year there were produced over 10,000,000 gallons, equivalent to 70,000 tons of grapes. The yield of grapes was therefore almost three tons, and of wine more than 400 gallons, per acre. At an average price of 15 cents per gallon for one-year-old wine, the value of the wine product of an acre of grapes is $60.

The value of all the wine produced in the county last year is now about $1,500,000. The average annual wine product for the past ten years is about 6,000,000 gallons.

In addition to wine grapes there are many choice table and raisin varieties grown.

Good grape land, unimproved, can be purchased at from $15 to $100 per acre, according to location.

SUGAR-BEETS.

Large acreages of sugar-beets are to be set out in Sonoma County this year, and the industry is assuming immense proportions. At Reclamation the California Hawaiian Sugar Company intends to set out over 1,800 acres, and a large force of men are employed at the present time. At Embarcadero, in the southeastern portion of the county, another large acreage, equaling that at Reclamation, is under cultivation. Both of these places are on tide water, and the overflow annually leaves a rich sediment on the land, which is particularly beneficial to the cultivation of the beets.

Splendid crops are annually yielded in this county, and in the near future it is probable that a large factory will be established for the purpose of extracting the sugar. Some time ago the Spreckels were considering the advisability of building a factory in this county, and construction may commence at any time.

TOBACCO.

Tobacco-growing has made a fair start and is one of the coming industries of the county. The plant will thrive in almost every section.

LUMBER.

The amount of lumber manufactured by the eighteen sawmills in Sonoma County during 1901 was over 15,000,000 feet. About 7,000,000 shingles are made annually in the county.

The handling of lumber and other forest products gives direct employment to about 2,000 men. A considerable business is done in wood and other split timber, about 20,000 cords of stove-wood alone being cut annually. A big business is also done each year in the handling of tanbark, etc.

The prices of Sonoma County pine and redwood lumber are as follows: Clear, or surface lumber, $15 to $18 per thousand feet; rough lumber, from $9 to $11; shingles, 40 cents per bunch; split pickets for fences, $17 per thousand. The average cost of a redwood fence is about $1 per rod.

MISCELLANEOUS ITEMS.

Labor here commands better prices, especially competent and experienced farm hands, than in the East or in any part of Europe.

Sonoma County has a large number of mineral springs. The seltzer water from one of these is considered the finest in the United States.

There are five incorporated cities in the county: Santa Rosa, Sonoma, Petaluma, Healdsburg, and Cloverdale; also, steps are being taken to incorporate Sebastopol.

Russian River is Sonoma's great waterway. The greater portion of the county is drained by it and its tributaries.

The assessment roll shows that the amount of taxable property in the county last year was $25,753,672, and the mortgaged property only amounted to $3,628,760.

The Japan current gives us unfailing rains and regulates the temperature both summer and winter.

The total expenditure on county roads in 1900 was $95,918.58. The number of miles covered by this sum was 1,185.

Of the amount collected in taxes, 20 cents on each $100 are spent upon the roads. Compared with the East our roads are more solid and permanent. This is due to the absence of excessive frosts, which crack and break up the hardest ground, of whatever material it is composed.

The many and varied health-giving mineral waters, fishing and hunting locations, and summer resorts, make this county a paradise for the pleasure-seeker. Thousands of visitors spend the summer months in this county, each year, living in tents pitched along the many beautiful streams and in the numerous picturesque spots.

PRICES OF LANDS.

Land values vary in price, according to quality, location, and what the land is wanted for. The rich river bottom land, with no crop, ranges from $200 to $300 per acre. Valley fruit land, not planted to fruit, from $75 to $125 per acre. Bench and hill lands suitable for hay, grain, or fruit, from $25 to $100 per acre; this includes vineyard lands. Stock ranges, from $5 to $25 per acre, which includes timber land.

These prices may seem, to some people, rather high, but when one considers what land produces here, the favorable conditions of the climate, and that such a thing as a total failure of crops has never been known, they can not be considered exorbitant.

We have in mind a place of 10 acres for which the owner paid $200 per acre for the bare land. Setting to fruit, and improving, cost him $1,500—making a total cost of $3,500. The present annual net income from the place is $1,000—or equal to 10 per cent on an investment of $10,000. Therefore the land is well worth the price paid.

WHAT CAN BE RAISED ON A SMALL FARM IN SONOMA COUNTY.

Secretary A. S. Luce, of the County Board of Trade, received the following letter, which explains what 10 and 20 acres can produce:

> Dear Sir: In compliance with my promise, I have looked over my books and have gathered some information which may be of interest to those who contemplate settling in these parts to follow fruit-raising.
>
> I will take two places, the entire products of which we handled last year, and I think

these will serve as an average of all of the orchards and vineyards where there is reasonably good cultivation, and most important of all where the products are successfully marketed.

The first place consists of 38 acres, and the result of last year's harvest was as follows:

20 acres grapes	$1,166 05
12 acres peaches	954 75
6 acres prunes	609 30
	$2,730 10

The second place has 13 acres, all in fruit and grapes:

8 acres grapes	$863 40
2 acres prunes	299 28
3 acres peaches	539 53
	$1,702 21

Last year was not a banner year by any means. Grapes were a good crop. Peaches were only fair, and prunes rather light.

I could give you numerous cases of single crops which far exceed in value per acre those mentioned, but think it more valuable to quote prices as an average.

There is a great opportunity for families to settle in this section, and ten acres of fair land will make a comfortable living for them if planted in a variety of fruit and good care applied. These small places are the most successful, as little or no outside labor is required, especially if there are children to assist in the gathering of the fruit, etc., so that the entire returns are realized to the benefit of the family.

We have the added advantage of ample market for all the fruit and grapes that can be raised, as we have a cannery, dried-fruit packing-house, and winery ourselves at Geyserville. There are also a cannery and several dried-fruit packing-houses at Healdsburg, and the wineries are too numerous to mention.

Yours very truly,

EDWARD WALDEN,

Of the firm of Walden & Co., fruit-growers and packers, of Geyserville.

STANISLAUS COUNTY.

Stanislaus County is one of the San Joaquin Valley group, and is bounded on the north by San Joaquin and Calaveras, on the east by Calaveras and Tuolumne, on the south by Merced, and on the west by Santa Clara. It extends across the entire width of the San Joaquin Valley, reaching from the summit of the Coast Range on the west well into the foothills of the Sierra Nevada on the east, and includes within its limits an area of 1,500 square miles, or 924,800 acres. Both its eastern and western borders present on the map greater breadth than the center.

The San Joaquin River, a navigable stream for eight months in the year, flows across the county some miles west of the estimated geographical center. From that stream diverge two tributaries, or arms, the Stanislaus and Tuolumne, both leading eastward to the Sierra, and both of which are navigable for from three to six months in the year. There are also several other streams of more or less importance throughout the county.

The greater part of the county is an almost level plain, stretching away in every direction until it merges into the foothill and mountain region on the east and west.

CLIMATE.

The climate of Stanislaus does not vary materially from that of the other counties in the San Joaquin Valley. The summer months are warm, and in July and August frequent hot days occur, when the mercury will rise to 100° and over. The autumn months are very pleasant, and the spring months perfect. During the winter, which extends from November to April, the weather, when no rain is falling, is all that could be desired—pleasant, balmy, and invigorating. Occasionally a light frost will occur, but seldom of sufficient severity to do any damage, except to the tenderest vegetation.

The average rainfall in Stanislaus is under the general average of the State, the precipitation at Modesto being about 9½ inches. The following table shows the average monthly precipitation at the principal points in the county:

	Jan.	Feb.	Mar	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Grayson	2.21	1.77	1.62	1.22	.44	.17	.00	.00	.01	.47	1.22	2.70
Hills Ferry	1.17	2.11	2.45	1.47	1.04	.41	.00	.00	.19	.32	.56	1.97
La Grange	2.86	2.75	2.55	1.48	.52	.08	.00	.00	.30	.93	1.98	2.22
Modesto	1.84	1.31	1.27	1.03	.40	.13	.01	.00	.11	.42	1.25	1.63
Oakdale	1.51	.53	3.41	1.56	.25	.05	.00	.00	.00	.30	.73	1.10
Turlock	1.05	1.70	1.62	1.54	.62	.38	.00	.00	.03	.64	.80	.97

SOILS.

On the eastern side of the county the soil is of a sandy nature, merging into loam as the foothills are approached. The prevailing soil on the west side is a rich loam of indefinite depth, and which under water is wonderfully fertile. The San Joaquin River divides the county a little west of its center line, and this is bordered by a belt of bottom land from 1 to 2 miles in width. The lands immediately adjoining this on the east side, for a width of from 1 to 5 miles, are principally adobe. The low lands adjoining the Tuolumne River are very sandy, while those along the Stanislaus are a dark, firm loam. In the central part of the county the soil is of a sandy character, especially to the south of the Tuolumne River, changing northward and westward to grayish and blackish loams. Some alkali patches are found in the lower lands, but these are not extensive.

IRRIGATION FACILITIES.

Two hundred and sixty thousand acres of the central portion of Stanislaus County, lying between the Stanislaus and San Joaquin rivers and bisected by the Tuolumne River, will within a few years comprise one of the garden spots of California. An irrigation system owned by the land embraces 176,000 acres at this writing, and although the system has been operative hardly more than a year, 20,000 acres are in alfalfa, fruits, and garden products. A year hence, 80,000 acres additional will be under irrigation ditches.

These irrigation systems are comprised in the Turlock and Modesto irrigation districts, organized under the Wright Act; the former comprising 176,000 acres lying between the Tuolumne and San Joaquin rivers, and the latter 82,000 acres lying between the Stanislaus and the Tuolumne rivers. The Tuolumne River is the source of supply for both districts. This stream has a watershed second only to that of one other river of the State, carries a vast volume of water, and is never-failing, being fed by the perennial snows of the Sierras. The water rights of the districts take precedence over all others save that of a mining company possessing a very limited appropriation.

The water is taken out of the stream, on either side, by means of a concrete dam constructed jointly by the districts at a cost of $550,000. It is located just above the historic mining town of La Grange, well in the hills of the Sierras, 32 miles distant from the centers of the districts, and constitutes one of the greatest and most spectacular structures of the kind in the world. It is 327 feet in length, 97 feet through at the base, 12 feet through at the crest, and 127 feet in height, arching up-stream. This dam has now been in place eight years, and is as enduring as the everlasting rock-ribbed hills into which it is keyed.

The Turlock District canal system comprises 22 miles of main canal 74 feet in width at the bottom, and designed to carry a maximum depth of 8 feet of water; two main laterals, aggregating 35 miles, 40 feet in width on the bottom; and six sub-laterals, aggregating 80 miles in length, ranging from 18 to 30 feet in width, floor measurement. The main canal of the Modesto District system, partially completed, is 60 feet in width on the bottom, and will supply 90 miles of laterals ranging from 18 to 40 feet in width. This system will be completed within a year from date—February, 1902. The Turlock District system represents a bonded indebtedness of $1,200,000 at 5 per cent, the bonds running forty years, no part of the principal payable until 1922. The Modesto District system represents a bonded indebtedness of $1,100,000 at 5 per cent, no part of the principal payable until 1922. The tax to defray interest and maintenance is about 40 cents per acre in the Turlock district and about 48 cents in the Modesto district, the property embraced in the city of Modesto paying two fifths of the Modesto district tax, which would otherwise be 80 cents per acre.

FRUIT CULTURE.

Stanislaus produces oranges—fine, luscious Navels—in marketable quantities about Knight's Ferry, Oakdale, Modesto, and Hickman. Her olives, too, go on the market, green and pickled and in the shape of olive oil. Her Bartlett pears, prunes, apricots, grapes, and wines are known and appreciated abroad, and peaches will in the course of a few years add to the fame of her climate and soil. Nuts do well.

The horticultural interests of Stanislaus have received comparatively little attention, wheat-growing being the general industry—her wheat product for 1901 being no less than 110,000 tons; but now that irrigation is available the production of fruit will rapidly assume proportions and within a few years become a very material industry. On the bench lands along the rivers are some of the very finest orchards and small vineyards in California; and here and there on the uplands, particularly about Knight's Ferry and La Grange, where irrigation has been available to a limited extent, and in instances on the plains where pumping has been resorted to, fruit and grapes are seen in perfection. The Assessor's figures (1901) in this connection show:

	Acres Bearing.	Acres Non-Bearing.
Apple	58	------
Apricot	151	------
Fig	44	------
Olive	108	23
Peach	162	74
Pear	47	------
French Prunes	163	23
Lemon	7	5
Orange	62	3
Almond	18	25
Walnut	1	2
Grapes	317	------

The sandy loam soil of which the bulk of the area of this great body of 260,000 acres of land is comprised, affords every advantage for intensive farming. Garden products are produced in abundance. Oranges, lemons, nuts, peaches, apricots, prunes, pears, nectarines, figs, olives, and table and wine grapes yield in gratifying quality and quantity; while alfalfa fields yield five crops of 1½ tons to the acre annually, and afford pasturage after the curing season.

Dairying interests are growing, promising to become a very prominent industry, because of the favorable conditions and excellent profits. A model creamery has been erected at Modesto, and skimming stations are being established in all tributary localities. Stanislaus County produced 700,000 pounds of butter during the year ending October 1, 1901, and the figures for 1902 will approximate 1,000,000 pounds. In addition to the butter product, her dairy interests are represented in the markets by large quantities of cream and cheese.

The famed Atwater sweet potato district adjoins the Turlock district—soil and climate of the same warp and woof. Turlock sweet potatoes are in as keen demand and bring as good prices as the Atwater product, and the yield is none the less heavy.

There are 10,000 acres in alfalfa on the West Side, stretching from Crow's Landing south to Newman, under a branch of the San Joaquin and King's River Canal, and the dairy industry in all its branches flourishes exceedingly, maintaining three creameries, a score of private separating plants, and a number of cheese-making institutions. Land in alfalfa rents for as high as $10 per acre per annum, the lessee paying the water rate. On the East Side, about Oakdale, we find a large percentage of the orchards and gardens; and alfalfa is now receiving considerable attention, the Oakdale Irrigation Company's system affording water for irrigation, the water being derived from the Stanislaus River through the medium of the Stanislaus and San Joaquin Canal Company's system.

LIVESTOCK-RAISING.

There are large bands of cattle and sheep in this county, most of them being driven to the mountains of Tuolumne and Alpine counties for summer range. Much attention is paid to breeding fine horses, and excellent grades are the result.

The poultry interests of the county are profitable and increasing. The Assessor returned 1,162 dozen in his last report. A lady near Modesto started the year with 40 dozen and closed it with cash and poultry representing a profit of over $100 per month.

The stock interests are quite extensive, in this connection the Assessor's figures showing:

		Valuation.
Beef cattle	103	$3,090
Stock cattle	9,610	146,395
Cows	4,225	104,415
Calves	5,900	41,670
Hogs, pounds	556,667	16,700
Mules	5,655	176,670
Jacks and jennies	38	5,090
Thoroughbred horses	26	1,925
American horses	3,279	88,990
Common horses	2,737	57,875
Mule colts	821	13,875
Colts	727	9,980
Imported or fine sheep	282	1,415
Common sheep	25,434	50,335
Lambs	11,758	10,115

CEREAL PRODUCTS.

And here, too, are some interesting and instructive statistics and comparisons, from the same source:

NUMBER OF ACRES SOWN FOR CROP OF 1901.

Wheat	255,270
Oats	185
Barley	50,625
Corn	60
Hay	1,920
Rye	17,280
Alfalfa	6,770
Total acreage	332,110

There were 20,330 acres less sown to wheat for the crop of 1901 than for the crop of 1900, and 50,000 acres less than for the crop of 1899; 8,435 acres more were sown to barley than in 1900, and 21,925 acres more than in 1899. The increase in alfalfa acreage to March 1st was 520 acres. There were 610 acres less hay. The increase in acreage of rye was very large.

PRINCIPAL TOWNS.

Stanislaus County has a population of about 10,000.

Modesto, the county seat, has first-class county buildings, substantial business blocks, good hotels, schools, churches.

Oakdale, on the Stanislaus River, 14 miles northeast of Modesto, is the center of a large fruit and grain region.

Knights Ferry, in the foothills, has fine orange groves, vineyards, winery, and flouring-mills.

Other towns are Waterford, Montpellier, La Grange, Ceres, Turlock, Grayson, and Newman—all produce and grain shipping places with large warehouses.

The timber of Stanislaus, used mostly for fuel, is scattering groves of white and live oak, and the scrub pines of the foothills.

LAND VALUES.

Farming lands range from $25 to $50 an acre, according to quality and location. The best bottom fruit lands can not be bought for less than $75 to $100 an acre, near the central shipping points. Remote from the towns lands are much cheaper. On the west side of the San Joaquin the Miller & Lux irrigation canals have brought water to a large acreage, which is now being devoted in small tracts to alfalfa, orchards, and vineyards, and 10-acre and 20-acre farms are no longer a novelty.

SUTTER COUNTY.

Sutter is the only county of California situated entirely in the great central valley of the State. No part of it extends to the foothills of either the Sierra Nevada or Coast Range mountains. As nearly all the county lies between the Sacramento and Feather rivers, the soil is mostly alluvial or delta land. The Sacramento River forms the entire western boundary, and is navigable throughout this entire distance of over 40 miles. The Feather River is on the east side, except in the southern part, where the county extends across the river, about 100 square miles being on that side of the river. The southern boundary of the county is only 12 miles from the State capital.

In size, Sutter is among the smallest in the State, its rank being 52, there being but five smaller. In population, it ranks 46; and in assessed valuation it is 39th. The average assessment to each voter in the State, outside of San Francisco, is $3,350. In Sutter the average is $4,310, being the highest of any county in the State, except the metropolis.

TOPOGRAPHY.

The area of the county is 611 square miles, or 391,040 acres. Of this the Butte Mountains and the tules constitute slightly more than one third. All the remainder is level, arable, and now under cultivation.

The Sutter Buttes are located in the northwestern corner of the county. This peculiar mountain formation lies about in the center of the Sacramento Valley. The peaks rise to a height of nearly 2,000 feet, while the whole extent of these mountains only covers about 40 square miles. The plains surround them on all sides, the level alluvial lands running up to the foot of the mountains, where the character of the soil changes from a sandy or clayey loam to a gravelly loam. Many small fertile valleys extend well into these hills, which, while not tillable, furnish excellent pasturage throughout the winter and spring.

Beginning on the southern side of the Buttes, and extending to the junction of the Feather and Sacramento rivers, is the Sutter tule basin. During the winter the water of Butte Creek, joined to the overflow from the Sacramento River, pours into this basin until it is filled to a depth of from 2 to 15 feet. In the spring and summer a dense mass of tules, a soft reedy growth, springs up, frequently to a height of 12 or 15 feet. In the fall and winter this dies down and is covered with sediment brought down by the next high water. This going on for ages has formed a soil of marvelous fertility. The area of this basin is about 125,000 acres. Several small sections of this land have been reclaimed by building levees, but the greater part is still in its natural condition. During recent years, the growing of late crops of beans and potatoes on this class of land has been found to be very profitable, and each year sees the area of such planting extended. Improvements now being made to the Sacramento River by the State and National governments will soon render this character of land still more valuable.

The arable land of the county is mostly a sandy loam with a heavy clay subsoil, which resists drought. A strip of adobe extends from the tules to the northern side of the county near the Buttes. The soil east of the Feather River is mostly red land.

HISTORY.

General John A. Sutter, after whom the county was named, made the first settlement in 1841, on the west bank of the Feather River, about 7 miles south of Yuba City. The Mexican Government granted him a tract of land comprising, according to the description in the grant, about four fifths of the present county. He established a rancho, planted trees and vines, and watched his herds of horses and cattle roaming at will over the plains. When California was made a State his grant was only confirmed to some 10,000 acres.

With the discovery of gold came an influx of American settlers, who rapidly acquired title to the unoccupied lands. At first the settlers did not think that the dry plains would produce crops without irrigation, and farming was confined to the bottom lands next the river. When Horace Greeley, in a speech delivered in Marysville in 1860, declared that those plains would produce grain without irrigation, people thought it to be idle talk, but within ten years thousands of tons were being harvested each season.

FRUIT-GROWING.

Fruit-growing as a commercial proposition was commenced nearly forty years ago by George Briggs, just below the town of Yuba City. He had there an orchard of about 300 acres, much of which has since been destroyed by débris from the mountain mines. The pioneer in grape culture was Dr. Chandler, who planted the first Muscatelle vineyard of 40 acres, 5 miles southwest of Yuba City. From these beginnings the acreage has been extended until at present the number of trees and acreage in vines are as follows:

Number of Fruit Trees.

	Bearing.	Non-Bearing.
Apple	4,830	------
Apricot	12,905	------
Cherry	3,595	------
Fig	2,591	------
Olive	2,100	------
Peach	134,910	22,525
Pear	21,907	1,200
Prune (French)	38,972	2,500
Prune (other kinds)	2,550	------
Lemon	1,568	------
Orange	4,497	------
Almond	33,730	1,744
English walnut	2,045	------
Totals	268,210	27,969

Acreage in Vines.

Table grapes	21	15
Raisin grapes	343	209
Wine grapes	19	------
Totals	383	224

During the present season tree and vine planting has been quite active. The number of trees planted will be about 50,000, of which not less than 90 per cent will be peaches. About 1,000 acres are being planted to vines, which are divided about 600 acres raisin grapes and 400 acres wine grapes.

Fruit-growing in Sutter County has passed through the experimental stage, and has become a tried and established industry. In early planting a little of everything was set out, on the plan that if one thing did not hit something else would, and the misses far exceeded the hits. Now it has been found that peaches are the crop; prunes, almonds, and pears following in the order named. Everything else is discarded, or nearly so. Other sections can do better than we can with apricots, cherries, etc. In the vineyard, nothing much is grown except Thompson's Seedless for raisins and Zinfandel for wine-making.

The crop of tree fruit in 1901 is estimated at about 30,000,000 pounds, although the shipments from the county would indicate a much larger amount, as much was brought here to be canned or dried or packed. The vineyard crop was cut short by a spring frost, which was the only serious one experienced in twelve years. This reduced the crop to less than half the average.

The Thomson Seedless raisin grape, which is the most extensively grown here, was first brought forward as a valuable grape by William Thomson on his place near the Buttes. About 1870 he bought four vines in Rochester, N. Y., and when they commenced to bear he found them to be different from the Seedless Sultana, at that time the only seedless grape grown in the State. By many it was considered superior, and soon was planted extensively. It has been found to be very profitable, now commanding the highest price of any raisin grown in the State.

MARKETS.

The market for fruit has broadened and become far more stable during the last few years. The cannery contracts for peach crops for periods of five years, if orchardists so desire. Dried-fruit buyers are always plentiful. One of the big San Francisco firms has a large packing-house in Yuba City. Both the green-fruit shipping firms have agents here during the season. A large part of the fruit shipped is now sold delivered on the cars. The greater part of the growers no longer consign fruit to commission houses. In preparing fruit for market the growers at present have a great advantage over those of a few years ago, in that as the industry has grown up there has grown with it a supply of trained help. Now there are plenty who know how to do the work, and it is well done.

Nearly every year sees one or more grain farms cut up and sold to orchard planters. Among those recently sold are the Stewart tract of 400 acres, Whyhr tract of 240 acres, Harkery tract of 200 acres, Littlejohn tract of 240 acres, Johnson tract of 400 acres, and others.

Experience has demonstrated that the industrious man with a small capital and a family can take twenty acres of orchard and make as much or more out of it than the grain-grower can make on a half section of good grain land. There have been no failures among the small orchardists.

STOCK-GROWING—MINING.

Stock-growing and dairying have always been quite extensive industries in Sutter. The Butte Mountains furnish winter pasturage for large flocks of sheep and bands of cattle, while the tule provides summer feed. Along the Sacramento and Feather rivers are many alfalfa fields. Dairying has received quite an impetus from the establishment of the creameries at Knight's Landing and Vernon, with skimming stations at Tudor and Nicolaus.

Sutter has never produced mineral wealth to any extent, although gold has been found in the Buttes. Indications of oil are abundant; one shaft, sunk more than thirty years ago, has never ceased to furnish a supply of gas. No use has ever been made of it, nor any attempt to search further. It is believed that coal can be found in paying quantities, as small veins have been opened.

CLIMATE.

The climate of the county, speaking broadly, is that of the entire Sacramento Valley. The prevailing wind from the south is a sea-breeze, which comes into the valley over the low hills about the bay of San Francisco. This wind at Sacramento is a west wind, but, striking the Sierra Nevada Mountains, it is turned north, and all the way up the valley is a south wind. During the summer, coming from the ocean it is cool and moist. The farther it goes north the less effect it has, so that points at the extreme north end of the valley have hotter summers than places 100 to 150 miles farther south. In winter it is a warm wind, and the same is true as to its effect near to or farther from its source.

When the valley has its occasional snow, say once in five years, it generally does not reach us. What is of most importance, however, is that spring frosts seldom interfere with fruit crops. The county, while located near enough to the sea to protect it from extreme cold, is yet far enough away so that fruit ripens much earlier than in the coast or bay sections.

The average rainfall of Sutter is ample; in fact, dry seasons, as a rule, produce the best grain crops, as was evidenced in 1898, when we had a dry year. The average of the summer-fallow grain was the best for several years.

PRINCIPAL TOWNS.

Towns are scattered through the county. The largest is Yuba City, with a population of about 1,500. In the north, near Butte County, is Live Oak, a railroad town. Near the Buttes is Sutter, where a high school is prospering. Meridian, on the Sacramento River, is in the rich river and tule country. Nicolaus is on the Feather River, and Vernon, 10 miles south, at the junction of the Feather and Sacramento. These, with Tudor, Pleasant Grove, Marcuse, Pennington, and West Butte, furnish ample trading facilities.

The past fifty years has seen an entire change in methods of farming from the loose stock-raising and grain-growing to the intense cultivation of fruits. He who fails to follow the tendency of the times can not succeed as he ought.

TEHAMA COUNTY.

Tehama County is situated on both sides of the Sacramento Valley, and reaches from the summit of the Sierra Nevada Mountains on the east to the summit of the Coast Range on the west, with the Sacramento River running through the center from north to south. It is bounded by Shasta on the north, Plumas and Butte on the east, Butte and Glenn on the south, and by Mendocino and Trinity on the west. It has a breadth of 38 miles from north to south, and a length of 78 miles from east to west, giving it an area of 3,125 square miles, or nearly 2,000,000 acres.

TOPOGRAPHY.

The surface of Tehama County consists, first, of a section of the Sacramento Valley, which, below Red Bluff, expands into a broad and level plain, swells on the west into low, level prairies, that farther on lift into broken hills, with the steep and rugged slope of the Coast Range beyond. Heading in these mountains, numerous streams flow east into the Sacramento, the principal of which are the Cottonwood, Dibble, Reed, Redbank, Elder, Thomas, and Stony creeks. On the east this valley is bounded by a lava flow, which extends for 20 miles or more up the western slope of the Sierra Nevada Mountains. Through these lava beds the large streams that carry the water caused by snow and rain on the slope of the Sierra Nevada have eroded deep, dark, and craggy cañons; above these lava beds the Sierra becomes more precipitous, rising at some points to an altitude of more than 10,000 feet.

To the north Mount Shasta lifts itself to a height of 14,442 feet above sea-level, 7,000 feet being covered with perpetual snow. On the east the Sierra Nevada stands as a great wall, linking the towering domes of Shasta and Lassen Butte, a volcanic cone over 10,000 feet high. To the west is the Coast Range, less lofty, but even more sharp and craggy in contour than the Sierra. The dark green of the coniferous forests that cover the lower slopes of these mountains contrasts strongly with the fields of snow that rest on their summits.

The average annual rainfall in the county is about 30 inches, which is more than falls farther down the valley. This large rainfall is very important to the agriculturist. It not only insures a much larger crop on the same kind of soil, and with the same tillage, but gives assurance against crop failures, as half that amount insures a fair crop. Half the rainfall of Tehama is more than the average amount of rain in some other portions of the State.

SOILS.

Tehama County embraces some of the finest soils in the State. They are mainly alluvial and volcanic in their origin. The Sacramento River, or its ancient predecessor, has deposited on either bank wide stretches of rich alluvium. On the east side is a dark brown, almost black, sandy loam, many feet in depth. Still eastward the land rises into slightly rolling hills of reddish soil, which soon run into the rough untillable lava beds. On the west bank the plain of tillable lands is wider. The soil on this side is in considerable part of a reddish tinge. The chief characteristics are the loamy river lands merging into a clayey loam second bottom; then the sandier soil of the plains, varying in color from gray to brown and red; then the roll of the hills begins, with reddish soil and gravelly loam predominating; next the bald hills of gray, brown, red, sometimes black, clayey loam, commonly called "adobe" hills, and still westward the hills rise higher, carrying a similar clayey loam covered with trees and underbrush abundant for firewood and not difficult to clear; and last, the elevation reaches the pine-clad summit of the Coast Range. The bottoms along the different creeks that flow into the river have their several peculiarities; but the usual soil, especially on the west side of the valley, is a yellowish alluvium, the area being generally not very wide, and joining more elevated benches of the soils already described. North of Red Bluff the soil undulates to the river banks, and is chiefly of a reddish clay and gravelly loam, and the wooded growth is more general.

There is very little waste land from the foothills of the Sierra to the foothills of the Coast Range. The beds of the streams constitute the greater portion of it. The different grades of soil will be viewed by different persons with widely varying opinions respecting their merits for profitable culture, yet there is very little doubt that all the soils, from the river bottoms to the coarsest gravelly hills, will be found available for some kind of husbandry. There is but very little of these lands that does not show a natural growth of trees and grass, indicating a soil ready to reward the intelligent cultivator. Large crops of grain, yielding as high as forty and more bushels to the acre, both on the bottom, the adobe hills, and the plains between, have fully demonstrated the fertility of all classes of the soil.

THE COUNTY'S RESOURCES.

Agriculture is the leading industry. Diversified farming is practiced very generally throughout the county.

Cereals of every description, alfalfa, and vegetables of all kinds do well. A large acreage was planted last season to sugar-beets.

At Vina is located the largest vineyard in the world, now the property of the Stanford University; and on this ranch is one of the choicest dairy herds of Holstein cattle in the State.

Peaches, prunes, olives, and pears are especially adapted for the county, as are all kinds of deciduous and citrus fruits, table and wine grapes, etc.

Livestock-raising is very profitable, especially the sheep industry; there being close to 200,000 head, yielding annually a large wool clip of a high grade.

Dairying is quite a prominent industry; also the feeding of beef cattle for outside markets. The ranges furnish natural forage grasses, there being over 700,000 acres of the finest grazing land.

Red Bluff is the county seat, with a population of about 4,000; it is the chief shipping point for the fruit crop. A large fruit cannery is situated here, also a large planing mill, and a box, sash, and blind factory.

Near Corning are located the famous Maywood and Ritchfield colonies; also a completely equipped establishment for the canning of fruits and vegetables.

The irrigation facilities of the county are excellent. The Sacramento River, and Antelope, Thomas, and Deer creeks furnish an abundant and never-failing supply of water.

The last report of the United States General Land Office gives the area of unoccupied public land as over 560,000 acres, described as mountainous, foothill, grazing, and agricultural.

TRINITY COUNTY.

Trinity County is bounded by Siskiyou on the north, Shasta and Tehama on the east, Humboldt on the west, and Mendocino on the south. It is oblong in shape, its greatest length running north and south for 90 miles, while its width from east to west, at its widest part, will not exceed 55 miles. Its area is 2,625 square miles, or 1,680,000 acres, all included in mountains.

Mountain barriers inclose the county on three sides. Upon the north lie the Scott Mountains, upon the east the Shasta, and upon the west the Coast Range. These extend their spurs into all portions of the county, leaving but a small part of its area free from their contact; the entire surface of the county is, in consequence, broken, rugged, and precipitous. To this formation the county is indebted for its abundant water-supply, and it is watered by numerous streams, all having their sources in the county, and flowing eventually into the ocean on the west. Trinity River, the largest of these, rises in the north, flows southward for about 40 miles, and then turns sharply to the northwest, receiving in its course the waters of many tributaries. The southern part of the county has also many streams, and is a mass of high, rugged mountains.

Weaverville, the county seat of Trinity, has an altitude of 2,000 feet, and its climate differs little from that of other places of like altitude. In the summer the mercury will get well up in the nineties, and occasionally reach as high as 105° or 106°, but this is rare. The nights are always cool. The winters are cold for California, and frosty nights are not uncommon, the mercury sometimes touching 10° above zero, which is the lowest recorded. Owing to the altitude of the county at all points, the atmosphere is dry and pure, and the extremes of heat and cold do not cause so much discomfort as they would in less elevated regions. There is an average rainfall of 46 inches a year, the smallest precipitation recorded being in 1874–75, when there were 24.72 inches, and the heaviest in 1877–78, when 63.95 inches were reported.

Trinity is essentially a mining county, and but little attention has been paid to agriculture. Hay Fork Valley is about 10 miles long and from 1 to 2 miles wide. Through it runs Hay Fork and Salt creeks, and there are numerous springs in it. Trinity Valley is about 18 or 20 miles long and from ½ to 2 miles in width. The Trinity River passes through it. These are the two largest valleys in the county, and outside of these the agricultural land is generally found in small patches. Some fruit is grown for home consumption, and apples, pears, and plums do well. Berries of all kinds thrive and yield abundantly.

Trinity is not a fruit-growing county, but along the streams and rivers, in the mining towns, and on stock ranches are small family orchards, the chief of which are found at Weaverville, Junction City, and the surrounding vicinity.

The apples raised are very choice, and other fruits are of excellent flavor, but are only raised in very limited quantities for home consumption.

The area of agricultural lands under cultivation is small, the principal products being barley, oats, and wheat. Vegetables are raised for consumption in the towns and mining camps of the county.

Stock-raising is followed with profit, the mountain ranges furnishing excellent and nutritious grasses.

Weaverville is the county seat. Other towns are Lewiston, Trinity Center, Douglas City, Junction City—all located in the vicinity of the mining industries.

The population of the county is now close to 5,000, having increased through the revival of the mining industry, especially in the quartz and hydraulic branches. Considerable placer mining is still being done. Copper and other minerals are found in paying quantities throughout the county.

The last report of the United States General Land Office gives the area of unoccupied public land as over 1,428,000 acres, described as mountainous, hilly, timber, and grazing.

TULARE COUNTY.

Tulare County, out of which three or four valley counties have been carved, is still one of the larger counties in the State. It is about the size of Connecticut, is almost square, and contains 4,935 square miles, or 3,158,400 acres. It is a wonderful county—wonderful for the height and beauty of its mountains, for its enormous groves of giant sequoia, for the fertility of its soils, for the abundance of watercourses, for the variety of products, for the prosperity of its people, for scenery that many declare to be superior to the Yosemite, for the highest mountain (Mount Whitney) in the United States on its eastern border, for the successful citrus territory, where are grown oranges that equal the finest produced, and for being the earliest territory to be settled up and devoted to agricultural purposes. Tulare is one of the greatest stock-raising counties in the State and the business is a legitimate part of agriculture. Cattle is raised for meat rather than for dairying, although the latter industry is keeping pace. The glory of Tulare is its deciduous fruit orchards, all along the channels of the Kaweah and Tule rivers. The soil is a deep alluvial loam, rich in nitrates and potash, and free from alkali.

Late frosts are rare. The spring is warm and early; and the heat of the summer, including the nights, which, while not uncomfortably warm, are free from the excessive chill common in some other sections of California, gives the fruit a perfect richness and sweetness.

While irrigation is general, at least to the extent of giving the trees one good drenching a year, there are many ranches where the underflow is only six to twelve feet from the surface, rising even higher in spring, and therefore no artificial watering is needed.

A canvass, made by the California Cured Fruit Association, of the bearing prune area of the county, shows that it is 2,800 acres. There were 14,200,000 pounds of cured prunes shipped from this district in the season of 1899, averaging over 3 cents, probably 3½ cents, a pound. The total shipment of deciduous fruit in 1900 aggregated about 30,000,000 pounds. Of this, more than half was dried fruit, largely prunes, and the remainder green or canned. In spite of a shortage of cars, 5,000,000 pounds of fruit were shipped. The picking, packing, drying, and canning of this crop calls for the services of nearly four thousand people (mostly boys and women), and this need of extra labor is experienced in all the valley fruit-growing counties in season.

The principal town and the county seat is Visalia. It is the oldest city in the valley, having been founded in 1852 by the brothers Vice, for whom it was named. It is a modern, well-improved, prosperous city, of about 3,500 people, with every prospect of continuous active growth in the future. In the old days it was the starting point of the overland stage, and to-day it is said of Visalia that it represents more per capita wealth than any other city of like population. Visalia is midway between San Francisco and Los Angeles, but it was not until

1897 that it was connected with the main lines of the railroad. The manufacturing interests include a flouring-mill, planing-mill, foundry, machine shops, granite-polishing plant, ice factory, bottling works, electric light plant, a fruit cannery, and four fruit-packing-houses. Electric power is supplied from a mountain watercourse, and it may be expected to give considerable impetus to local manufacturing.

Tulare City is the second in point of size in the county; it is about 10 miles south of Visalia, and has a population of about 2,500. The main line of the Southern Pacific, and the Tulare-Visalia line of the Santa Fé, pass through the city. In the surrounding country, cattle, hogs, and horses are raised, and there are flourishing orchards and broad wheat and alfalfa fields. It is supplied with substantial brick buildings on broad, beautiful streets. The removal of the railroad shops, and some unfortunate litigation in which the city became involved, served for a time to retard its growth; but as it possesses the fundamental elements of agricultural success, in climate, soil, and plenty of artesian water, it will hold its own with other places in the county.

The famed citrus fruit belt of Tulare lies about 20 miles east of Visalia, and includes a series of settlements or districts, chief of which are Lindsay, Exeter, and Porterville. This land is practically frostless. Throughout the upper portions of the valley, as the Sierras approach the plain, there intervenes a broad mesa, or table-land, averaging about 600 feet in elevation. This does not exist in Tulare County, where the mountains rise direct from the plain. The cold air, drawn from the upper levels, is carried over this little strip of land, nestling close to the side of the mountain, and it thus escapes frost.

The soil is shown to contain in exact proportions the elements needed for the growth of citrus trees. Freedom from fog gives immunity from insect pests, which need moisture in the air to prosper. The long warm summer brings the fruit to maturity earlier in the season than is the case farther south (where the nights are colder), and, as a result, Tulare County fruit reaches the Eastern market in November and the first weeks of December, in time for the Christmas trade. This is a great practical advantage.

Most of the district has a plentiful supply of water in the form of an underflow—a natural reservoir at a depth of from 50 to 75 feet. It is raised by pumping. Formerly the pumps were operated by gasoline, but electricity is now available at a reasonable price. Farm houses are lighted by electricity, and the cities of Visalia and Tulare and the towns of Exeter, Lindsay, and Porterville are supplied from the same plant.

There are about 5,000 acres under cultivation in citrus fruits, of which only a small part is in full bearing. The product averages about 700 carloads yearly, and is rapidly increasing. The Porterville oranges have repeatedly carried off first prizes in the citrus fairs of the State when entered against the products of the best sections of Southern California.

In the northwestern part of the county, in the Alta district, a considerable acreage is devoted to raisins. These do quite as well in this county as in any other section of the valley, although their cultivation has not been attempted on so extensive a scale as elsewhere.

Tulare County is forging ahead with gratifying speed. In the year 1901 improvements made have eclipsed any previous period. Butter factories have been established at Tulare City, Rockford, and Burton, and these factories are in a flourishing condition. A skimming station has been established at Monson. A condensed milk factory, with a capitalization of $25,000, will soon be established in Visalia. It will be operated in conjunction with the Visalia ice plant. Six hundred and fifty acres have been set out to citrus fruits since January 1, 1901, all of which land is located in the foothill country surrounding Exeter, Lindsay, and Porterville. During the year, about 11,000 acres of new land has been brought under cultivation and planted to alfalfa, with satisfactory results. There has been a marked increase in the dairy interests. A conservative estimate places the number of cows now in the county at four hundred more than at the beginning of the year. Another noticeable gain was made in horses and mules. There is a growing demand for draft horses and large-boned, big-muscled mules, and these animals command good prices. Thirteen hundred acres of barren land have been reclaimed by artificial irrigation, and this satisfactory result has led to the building of more ditches. One new irrigation canal, 5 miles long, near Porterville, which has just been completed, carries water to one tract of 2,800 acres.

TUOLUMNE COUNTY.

The geographical location of Tuolumne County is in Central California, and is known as the Southern Mines. It is situated on the western slope of the Sierra Nevada range, and is bounded on the north by Alpine and Calaveras counties, on the east by Mono County, on the south by Mariposa County, and on the west by Stanislaus and Calaveras counties.

Tuolumne County is 150 miles nearly due east from San Francisco, and varies in width from 8 to 12 miles. The eastern portion of the county extends into the western slope of the Sierra Nevada range. The entire surface may be said to possess a rugged character, with many small and fertile valleys and meadows, together with sloping hills heavily covered with timber.

The county seat is Sonora, being upon the line of the railroad, and about the center of the county.

The Sierra Railway connects at Oakdale with the line of the Southern Pacific Company, extending thence 53 miles in an easterly direction to Tuolumne, at which point junction is made with the Hetch-Hetchy & Yosemite Valley Railroad, which reaches into the high Sierras beyond, tapping the vast timber belts, and affording transportation at reasonable rates for lumber and mining material. The railroad passes directly through all the large towns of the county, and makes stage connections for outlying places. The above railroad was completed to Tuolumne in the spring of 1900.

A branch road from Jamestown to Angels, Calaveras County, is nearly completed, being the only railroad into that county. This branch road will open to location a great deal of land that heretofore has been inaccessible.

Tuolumne County has made some wonderful strides during the last five years, and those who visited the county at that period would now wonder at the advancement and improvements made. While the railroad has worked a hardship to some of our towns, by shutting off staging and teaming, it has been the means of bringing into the county many people who never would have come if compelled to travel by stage. The population of the county has increased; the assessment roll is larger; mining machinery can be placed at the mine for less cost; and every point in the county can be reached within twelve hours' ride from San Francisco.

The scenery of the county is unsurpassed. Its streams afford pleasures to the sportsman equal to any place in the State.

Tuolumne County is noticeable for its many roadways, aggregating something over 400 miles.

During the last six years the mining industry has been steadily on the improve. While mining is our greatest factor, the timber industry is fast coming to the front (which is worthy of note) at Tuolumne, which is the terminus of the Sierra Railway and the junction of the Hetch-Hetchy & Yosemite Valley Railroad. This town was laid out by the West Side Flume and Lumber Company in 1899. Since that time the company has installed a large sawmill plant, capable of turning out over 100,000 feet per day. It has also completed a box factory, which will employ many hands. The company, in its various branches, has over 1,000 employés. It has erected a fine hotel, also a large general store with offices overhead, and its lumber yards cover a large area of ground. It has a narrow-gauge railroad which extends into the heavy timbered mountains, a distance of 25 miles. Logs are placed on flat cars, and hauled to the sawmill in Tuolumne. This town is but a quarter of a mile west of the old town of Carters, and both are surrounded by producing mines. The company has expended large sums of money in this enterprise, but is now commencing to receive dividends upon the investment.

CLIMATE.

The climate of Tuolumne County is very even; mean temperature, 70°. During the summer months the thermometer registers from 95° to 100° at the most, and then only a day or so at a time. The nights are cool and comfortable.

During the winter months 20° is often registered; but such days as are not rainy are generally sunny and pleasant. The nights as a rule are not uncomfortably cold.

In the high mountains about 30 miles east of Sonora, more rigorous weather prevails.

Rainfall, about 43 inches, on an average.

STATISTICS.

Output of Tuolumne County mines up to the end of the year 1901 is $233,000,000, which amount includes early-day placer mining. The present yearly output is about $2,000,000.

Some of the greatest producing mines in the State are located in Tuolumne County. There are about 500 patented mines, and in 1901 630 locations were recorded.

In the county there are about 1,200 stamps in place. The Eagle-Shawmut mine, near Jacksonville, is installing 150 additional stamps.

Population of county, 11,890; being an increase of 83.2 per cent during the last decade.

Assessed valuation of property, $5,692,542.

Area of entire county, 1,956 square miles, or 1,256,000 acres. Government reserve, 360,320 acres; Yosemite reserve, 491,280 acres; open for settlement, 367,895 acres.

TIMBER BELT.

The timber belt of Tuolumne County is great in its dimensions, comprising 60 per cent sugar pine, 20 per cent yellow pine, and the balance cedar and fir. Upon some tracts the timber will run 300,000 feet to the acre, some of the trees measuring 33 feet in circumference and 300 feet in height.

The Tuolumne grove contains about 1,300 sequoias greater in dimensions than those of Calaveras.

SCENERY.

Table Mountain is, topographically, the most prominent feature of Tuolumne County. It extends between 20 and 30 miles along the central portion of the county, having an almost level top, lava-capped, with perpendicular sides rising to a height of 2,000 feet above the Stanislaus River. It was built up from a lava flow which first filled an ancient river channel, from which millions of dollars have been extracted, and where great deposits of gold still remain. As one travels through the county by team or on the railroad this mountain presents a most inspiring view.

Another noticeable feature is Hetch-Hetchy Valley, which equals the famous Yosemite in beauty and grandeur, although not as large. Situate therein is Lake Elnor, which is filled with mountain trout. The valley is inhabited by all kinds of game.

STRUCTURAL GEOLOGY OF THE COUNTY.

The famous Mother Lode traverses the entire western portion of the county, upon which is situated the Eagle-Shawmut, Republican, Clio, Jumper, Dutch, and Rawhide mines, also many others of minor note.

The foot wall of the Mother Lode is serpentine, with eruptive dikes accompanying the lode; while mineralized slate forms the hanging wall. To the east we come to the granite, some of which is basalt, with eruptive dikes in places; then comes what is known as the Calaveras formation, which is slate, covering a large area; farther east comes in granite again.

All east of the Mother Lode is what is known as the East Belt, upon which is situated many fine producing mines, together with prospects held under possessory title; there is also ground open for location. The East Belt in the last five years has made quite a record, and is fast coming to the front as the principal mining section of the Southern Mines.

The following list shows some of the metals found in Tuolumne County: Gold, silver, copper, arsenic, antimony, galena, zinc, iron, amphibolite, obsidian, asbestos, manganese, corundum, barite, and marble.

Tuolumne County has experienced no boom, but during the last six years its mineral productions have kept steadily on the increase, and taking in consideration her population, it is astounding the amount of gold produced each year. Considerable space could be devoted to the mining industry of the county, so will state that the Progressive Association of Sonora has issued a pamphlet thereon, including a map of the mineral belt, which can be obtained upon application to that association.

WATER-SUPPLY.

The main rivers of the county are the Stanislaus and Tuolumne, which form tributaries to the San Joaquin.

The Tuolumne has its source entirely within the limits of the county, and may justly be termed the river of a thousand lakelets, although a number of these strictly come under the head of lakes; Lake Elnor, the largest, being 2 miles in width and 4 miles in length. The main or principal branch of the river flows through the Hetch-Hetchy Valley. This branch, with its many tributaries, commands about three fourths of the entire watershed of the county.

The Stanislaus River, to the north, with one of its branches forms the boundary line of this county and Calaveras.

From the main stream of the Stanislaus River to south fork thereof, at a point where the upper dam of the Tuolumne County Water Company is located, there is a tunnel over one mile in length, costing about $250,000.

The water-supply at present is controlled by the above-named company, which was organized in 1852. The supply is ample for all requirements, being used for mining and irrigation purposes. It is furnished by a system of dams, reservoirs, and canals. The main canal runs from the south fork of the Stanislaus River, about 18 miles above Columbia, and extends to that town and vicinity. The size of the main canal is 7 feet on the bottom and 13 feet deep, with a grade of 16 feet to the mile. The main flume at the head is 7½ feet wide and 2 feet deep. The canal carries 2,100 inches of water in the summer season. There are three timber dams, all upon the south fork of the Stanislaus River. The lowest one is at Strawberry Flat, from 13 to 15 miles by way of the river to head of the ditch. One mile above is the second dam or reservoir, and 10 miles above the lower reservoir is the big dam. The capacity of the three reservoirs is equal to something over two months' supply. About 6 miles from the head of the main canal is a lateral ditch, with a capacity of 500 inches. This is 9 miles in length, and supplies all mines in the vicinity of Carters, Tuolumne, Soulsbyville, thence to Algerine section, 8 miles south of Sonora.

Four miles east of Sonora is located Phœnix Lake, which is the lower distributing point, covering Sonora district and the Mother Lode. At Phœnix Lake is located an electric power plant of 2,500 horse-power, owned by the aforementioned company. This plant supplies electrical power and lights to all the principal mines upon the Mother Lode. The canals and ditches aggregate about 100 miles in length, and distribute water over an area of 200 square miles.

The towns of the county are furnished with electric lights from power furnished by a plant situate upon the south fork of the Stanislaus River, 8 miles north of Sonora, and owned by the Tuolumne County Electric Light and Power Company.

FRUIT CULTURE.

In many places the soil of Tuolumne County is admirably adapted to fruit-growing, and in the foothills some of the finest apples in the State are grown. Semi-tropical fruits of every variety, and vines are cultivated, and yield an abundance of highly flavored fruit. The almond and walnut are cultivated, with encouraging results.

The county is not largely devoted to this industry, although the sections where small orchards of all varieties are cultivated prove that certain localities in the county are particularly adapted to fruit. Lemon and orange trees do well in the southern portion of the county.

Large quantities of grapes are shipped from the county each year, while the second class is made into wine of good quality.

Apples sold in Sonora during recent seasons for $15 per ton; they were purchased by the McComber Cider and Vinegar Works. The above company planted trees in 1852, which were imported at a cost of $2.50 each.

Champagne cider manufactured by McComber Bros. has a reputation throughout the United States.

The sunny, sheltered hillsides of Tuolumne County offer inducements for the culture of fruits. Land for such purpose can be purchased for from $10 to $20 per acre. With the present system of water ditches, such land can easily be irrigated, and when once planted to trees would double in price.

STOCK-RAISING.

Most of the stock-raisers produce sufficient hay for their own use; considerable is raised upon small farms, also. Little, if any, is shipped out of the county. During winter months hay sells for $30 per ton in the mountains.

Stock-raising is controlled mostly by feed—by those who have ranges in the mountains for summer and pastures in the foothills for winter; although those controlling smaller tracts of land raise a few.

In the mountains in certain sections there is to be found meadows upon which grows the finest kind of bunch grass, while upon its hillsides wild oats and timothy afford a splendid feed.

In some sections, and especially in the neighborhood of Groveland, the ranges are so sheltered that it is not necessary to remove cattle the entire year, and as a rule the stock remain in good condition the entire season.

PRICES OF LAND.

Grazing land is held from $4 to $8 per acre, while timber land ranges from $8 to $20 per acre.

PRINCIPAL TOWNS.

The principal towns of the county are: *Sonora* (county seat) is situate about the center of the county, with a population of about 4,000. It has an elevation of about 1,825 feet, and is considered an exceptionally good business town. There has recently been finished one of the finest court-houses in the State, absolutely fire-proof, and even age can not impair it. To the present Board of Supervisors, and especially the chairman, is due credit for this fine structure.

Columbia is situate 4 miles to the north of Sonora. It is one of California's famous mining camps of early days.

Tuolumne and *Carters* lie 10 miles east of the county seat, and are situate in the center of the wonderful East Belt mining district, and have an exceptionally bright future, being the terminus of the Sierra Railway, and the junction of the Hetch-Hetchy & Yosemite Valley Railroad; also the headquarters of the West Side Flume and Lumber Company. Their population has increased in last thirty months from 1,000 to 4,000 souls.

Jamestown is 4 miles south and west of Sonora. The main offices of the Sierra Railway are located here. The railroad leading to Angels, Calaveras County, branches at this point, and will soon be completed.

Quartz and *Stent* are the next towns south, then comes *Chinese*, 12 miles soutwest of Sonora, being the point where tourists take the stage for Yosemite Valley via Big Oak Flat and Groveland.

Jacksonville lies 12 miles south of Sonora, at which point there is at present being installed an electric power plant, which will furnish electrical power along the Mother Lode, and to mines situate in the district of Groveland and Big Oak Flat.

Groveland and *Big Oak Flat* are situate 22 miles southeasterly from Sonora, being across the main Tuolumne River, and in a rich mining section. There is to be found in this section many fine stock ranges, also some of the most comfortable mountain homes in the State. Fruits of all kinds thrive most luxuriantly in the many fertile valleys.

Soulsbyville lies 7 miles east of Sonora, in the heart of a rich mining section, and where is located the famous Soulsby mine that has produced $5,000,000, but which has remained idle for a number of years. It has recently been reopened, and is producing as of old.

Confidence and *Sugar Pine* are situate still farther east, about 17 miles from Sonora, being near the line of the snow belt. They are supported by surrounding mines.

Strawberry Resort, situate about 35 miles north and east of Sonora, is becoming very popular with Oakland and San Francisco people, and is looked upon as the ideal fishing point in California. It has only been open a few seasons, and as yet is not thoroughly known. Any and all first-class accommodations can be had at this resort, and one is assured fine sport with both rod and gun.

VENTURA COUNTY.

Ventura County is located between the Mojave Desert on the east and the ocean on the west, and between the counties of Los Angeles and Santa Barbara. It is bounded on the north by Kern and San Luis Obispo counties, on the west by Santa Barbara, on the east by Los Angeles, and on the south by the Pacific Ocean. It has an area of 1,628 square miles, or 1,041,920 acres. Of this nearly 1,500 square miles are mountain and desert, valuable chiefly for their mineral products.

The arable area, however, is considerable in extent, much of that regarded as desert being very fertile under water, while through the mountains are found numerous little valleys. These valleys are of every shape and extent: from the broad expanse with square miles of level land to the little pocket among the hills. The principal of these is the Santa Clara. This valley extends nearly east and west across the county, and is traversed by the Santa Clara River, fed by numerous tributaries, as the Castis, Piru, Sespe, and Santa Paula. The average width of the valley is 10 miles, and large ranches extend from one end to the other.

Next in importance comes the Ojai Valley, a great amphitheater, whose walls are mountains rising like citadels in all directions. Overlooking the whole is Mount Topo-topa, rising to a height of 6,000 feet. This basin is well timbered, and has a very productive soil, giving the largest wheat yield per acre in the county. The Ojai Valley as a whole will attract, and that at no very distant day, hundreds of people who will engage in the raising of citrus fruits.

Other valleys are the Conejo, 1,000 feet up on the northern slope of the Guadalasca Mountains, well watered and admirably adapted for raising grain; the Simi, with its splendid oak forests and grazing lands; the Santa Ana, with its cultivated farms and orchards, its trout streams, and clumps of rhododendrons; the Las Posas, with its immense wheat fields and semi-tropic fruits; the Sespe, lying along each side of the Santa Clara River and the San Buenaventura Valley, narrow but picturesque, watered by the Ventura River, and dotted with pleasant homes.

The Santa Clara River traverses the entire length of the county from northeast to southwest. It is fed by several tributaries which rise in the mountains near the Santa Barbara line, chief of which are the Santa Paula, Sespe, and Piru, the latter having its rise in Kern County. The Ventura River rises in the San Rafael range, flowing nearly due south, and is fed by numerous springs and mountain streams. These two rivers reach the ocean but about six miles apart. They furnish abundant water for irrigating purposes when needed, Ventura being one of the best watered counties in Southern California, as nearly every valuable farm in the county can be reached with flowing water.

The soil in the valleys is generally a rich, inexhaustible loam, varying from 10 to 150 feet in depth, and yielding enormous returns for the labor expended upon it.

CLIMATE.

The climate of Ventura County is adapted to a great range of agricultural pursuits, and in the different parts of the county nearly all varieties of fruit, except those of the tropics, can be produced. Near the coast the mercury seldom falls below 34°, or rises above 83°. In the valleys farther back from the ocean the weather grows hotter in the summer and cooler in the winter, the mercury sometimes reaching the freezing point in January and February, and leaving 100° behind in July and August. In the mountains snow sometimes falls in the winter months, but never visits the valleys.

RESOURCES OF THE COUNTY.

The agricultural and horticultural resources of this county are of the highest order, and the following are returns of the crops of 1901: Lima beans, 525,000 sacks; other varieties, 35,000 sacks; walnuts, 1,000 tons; dried apricots, 1,000 tons; dried prunes, 75 tons; honey, 12 tons; sugar-beets, 140,000 tons; barley, 200,000 sacks; wheat, 150,000 sacks; hay, 10,000 tons.

In 1901 the bean crop largely exceeded that of the previous year, while the average price realized was $4.25 per cental, bringing to the bean-raisers of Ventura County during the year 1901 the large sum of $2,699,000.

Eleven thousand acres of sugar-beets will be planted at Chino this year, 4,000 acres more than ever before. At Los Alamitos 7,000 acres will be planted, which is the largest acreage ever sown there. The acreage at Chino will be 20,000, far beyond any former record. These three items total 38,000 acres. There is a factory at Santa Maria still to be heard from, which will put the total close to 50,000 acres. This is more than 100 per cent increase on any former year. The amount of money involved and labor employed make large figures. The farmers are supposed to get about $60 per acre for their crops, on an average, which makes the amount $3,000,000.

The following details of the campaign of 1901 show that sugar-beets are not only a very profitable crop, but demonstrate the fact that the Santa Clara Valley in Ventura County is the ideal locality for their cultivation, both for tonnage, yield per acre, and percentage of sugar contained: Number of acres planted in 1901, 12,535; number of acres harvested, 11,399; number of tons delivered and sliced at the factory, 161,740; average yield per acre, 12.23 tons; average price paid per ton, $4.83; average amount realized per acre, $59.08; average per cent of sugar, 17.6; highest average yield in any entire field (near Oxnard), 31.05 tons; highest amount realized from sale of beets, per acre, $144.22; highest average per cent of sugar in any field (near Hueneme), 24.9. A study of the foregoing will show how valuable are the lands that produce such results, and $250 per acre, the prevailing price for choice bean and beet land, is not too high.

The honey crop of the county is over 2,500,000 pounds annually; the bees having a large and varied range to gather honey from the abundant blossoms in the mountains and valleys.

The dairy industry is quite extensive and profitable, the cattle being mostly of pure breeds or high-class grades. Up-to-date and model creameries and skimming stations are located throughout the county.

Large quantities of hay of a very fine quality are raised, over 10,000 tons being shipped in 1901. Wheat and barley are the leading cereals, the crop last year of the former being 200,000 sacks and of the latter over 150,000 sacks.

Vegetables of every description thrive and large quantities are shipped to outside markets.

Other crops raised in the county are citrus and deciduous fruits, and walnuts. These have generally yielded satisfactory returns.

The oil industry in 1901 has been prosecuted with much vigor by those engaged in it, and has yielded better results than in any previous year.

The principal towns of the county are San Buenaventura, Oxnard, Santa Paula, Hueneme, and Ventura, besides other smaller and thriving ones.

The last report of the United States General Land Office gives the area of unoccupied public land as over 146,000 acres, described as mountain and rolling.

YOLO COUNTY.

Yolo County is acknowledged by all who are at all acquainted with its wonderful fertility, to be the gem of the great Sacramento Valley. Approaching it from the north or from the south, one is at once impressed with the increasing richness of the soil, and it is hardly necessary to look for the county line guideboard to know that you have crossed the line and are in the most fertile county of this great State. It is bounded on the north by Colusa County, on the west by Lake and Napa, on the south by Solano, and on the east by Sutter and Sacramento, the Sacramento River running the entire length of its eastern border. It has an area of 1,018 square miles, or 650,880 acres, being one of the smallest counties in the State.

TOPOGRAPHY.

Probably four fifths of its area is level, but the western portion breaks into hills, with cañons and valleys of considerable extent, chief of which is Capay Valley, noted as one of the earliest fruit sections of the State, further mention of which is made below. The hills are nearly all used for grazing, except the numerous homesteads scattered throughout the area. Along the eastern side of the county, near the Sacramento River, is what is known as the "tule basin," which contains about 40,000 acres. These lands are overflowed during high water, but as the water recedes they furnish rich and succulent pasture for immense herds of stock. It will thus be seen that the county has very little waste land.

WATER-SUPPLY.

The two principal streams are Putah Creek and Cache Creek, the former being the boundary line, for a portion of the way, between Solano and Yolo counties. Cache Creek is the outlet of Clear Lake, and where it leaves the hills it flows east, through the center of the county. Clear Lake, which lies in Lake County, is 25 miles long and about 8 miles wide, and receives the drainage of 420 square miles of the Coast Range. Its elevation is 1,300 feet above sea-level, and with Cache Creek as its only outlet, it will be seen that nature has furnished one of the most magnificent natural reservoirs to be found in the entire State, and probably in the whole United States. It is estimated that 50,000 horsepower could be generated by the waters of Cache Creek. and the water still be used to irrigate every acre of land on each side of the creek, after it reaches the valley. That such an opportunity for the profitable investment of capital should remain so long without being utilized, is little less than marvelous. The present irrigation facilities are limited in extent, the Moore Ditch Company covering only about 25,000 acres. A more comprehensive system is now being worked up, by which it is proposed to cover 50,000 to 100,000 acres, and the system to be owned by the farmers themselves. It remains to be seen whether they will grasp the opportunity offered them, or will let the prize fall into the hands of a private corporation, and forever after be at its mercy.

SOILS.

During high water, Cache Creek has brought down from the hills and mountains immense quantities of the very cream of the soil, and for ages has been depositing this upon the land. The result is, that the soil, which is a rich sedimentary deposit, is from 20 to 30 feet in depth, entirely without hardpan, and is as rich as the valley of the Nile. This is particularly true of a large area around Woodland, of which Professor Wilson, of the University of California (see Bulletin No. 100, page 162), says: "There is a strip of this material at Woodland, several miles wide, extending a distance of 18 miles. There is no finer agricultural soil than this sedimentary deposit. It is warm and fertile, with good drainage, yet holding a reserve of moisture to resist drought. It is ideal fruit land. You may find growing on this soil, wheat, barley, oats, corn, alfalfa, all the vegetables of a temperate and sub-tropical climate, apples, apricots, nectarines, plums, pears, peaches, prunes, oranges, lemons, limes, figs, pomegranates, grapes (table, wine, and raisin), olives, almonds, walnuts, berries, and melons. Some of these lands are better adapted to particular crops than others, yet I venture to say that there are eighty-acre tracts of this sedimentary soil in this valley, on which everything that has been named is now produced, and I am not sure but that within a single block in the town of Woodland most of these fruits and vegetables can be found growing."

As a matter of course, not all of the land of the county is as fertile as that described by Professor Wilson, but it is true that no other county in the State has so large an unbroken body of strictly first-class land. The same quality of soil is found in many other sections of the county, but not in as large an unbroken body as around Woodland, notably the sections around Knight's Landing, Yolo, Davisville, Winters, Esparto, Capay Valley, and the Sacramento River region. The foothills in the western part of the county, from Winters to Capay, and north, as well as those bordering Capay Valley, are mostly a very fertile soil, and a great many have planted orchards and vineyards, the warm soil and exemption from frost making it a very desirable location. As a proof of what has been said, we point to the fact that in this small county, the assessed valuation amounts to over $16,000,000, the tax rate is the smallest of any county in the State, and not a dollar of indebtedness.

CLIMATE.

As regards climate, Yolo County is particularly favored. The average winter temperature is 48.3°; average summer temperature, 77.7°; average annual temperature, 62.8°. The winter season is often entirely free from frost, while other seasons show a temperature as low as 20° above zero. This, however, is exceptional, and does no particular harm, as it comes at a time when all fruits, including oranges, have been gathered. The summer temperature often reaches 100°, and nearly every season, during a hot spell, the temperature would exceed the 100° mark, but this is only for from one to three or four days. Nearly every afternoon during the summer a cool, refreshing breeze comes in about three o'clock. The evenings are the crowning glory of Yolo's climate. A person can sit outside without a wrap, the gentle breeze being just sufficient to make a perfect temperature. There is no raw, chilling wind, no dew at all, and nature seems to have done her best to make this the ideal evening climate.

The average annual rainfall is 17.25 inches at Woodland, but in the western part of the county, along the foothills, the precipitation is considerably more.

PRODUCTS OF THE COUNTY.

The products of Yolo County, as has been stated above, are varied· Until within a few years, the cultivated area was devoted almost entirely to the production of wheat and to stock-raising. She still holds the banner as the largest producer of wheat and barley, according to acreage, but in the meantime she is coming to the front as a fruit producer. Edwin S. Holmes, Jr., of the U. S. Agricultural Department, credits Yolo County with 1,114,300 bearing fruit trees, or over one eighth of the bearing fruit trees of the entire State. The statistics showing the number of cars of the different kinds of fruit shipped from Yolo County are not obtainable, but the above will show that it was no small item.

The grape industry is also a very important item, and is represented by an area of 2,000 acres of table grapes, 10,000 acres of raisin grapes and 8,000 acres of wine grapes. Yolo County has the honor of producing the first raisins of commerce ever made in America, and the late R. B. Blowers was the pioneer grower. The Seedless Sultana grape, which is grown here quite extensively, makes a very plump and "meaty" raisin, and for years the Woodland Sultanas have been acknowledged by the trade to be the best Sultanas in the State. The most of the Sultanas grown here are bleached, and last year over 90 per cent of all the bleached Sultanas of the State were produced in the Woodland district. The shipment of table grapes to the New York market is also quite an industry, and Yolo County stands well to the front as regards quality, and prices received, only one other section leading her.

Yolo County has been noted for years for producing some of the fastest horses in California, and any day, on the streets and roads, can be seen as fine specimens of driving horses as one would care to look at. Woodland has been a center from which thousands of horses and mules have been shipped during the past few years, and they have gone to all parts of the country, notably to Hawaii, the Philippines, South Africa, and to the Southern States.

The dairy interest is becoming quite a factor in this county. Five years ago, when it was proposed to erect a creamery, many of the farmers hooted at the idea of making first-class butter in this hot valley. The creamery was erected at Woodland, and is now annually turning out over 150 tons of as fine butter as can be found on the Pacific Coast. It is all handled by one firm, and they claim that the product does not more than half supply the demand. This creamery alone disburses $75,000 among the farmers each year. There are now four creameries in the county, besides three skimming stations, and the dairy interest is increasing by leaps and bounds.

It is estimated that there are 40,000 acres of alfalfa in the county, and the area is rapidly increasing. As each acre, if cut for hay, will yield from six to eight tons, it can readily be seen how important the dairy interest may become. For stock of any kind there can be no better feed than alfalfa, either green or cured for hay. This accounts, in part, for the herds of fine cattle and sheep.

The pure Spanish Merino sheep of the Bullard estate have a world-wide reputation, and shipments have been made to all parts of the world. These parties are now forming a new flock of the Rembouillet Merino, having imported from Germany, three years ago, five bucks and twenty-five ewes of the very choicest specimens. They are also building up a very fine herd of Durham cattle. Numerous other parties have fine herds of Durham, Jersey, Holstein, Hereford, and Brown Swiss.

PRINCIPAL TOWNS.

The county seat of Yolo County is Woodland, a beautiful city of 3,500 population. Its streets are wide and clean, and are lined with shade trees, while here and there about the city can still be seen some of the majestic old oaks which suggested the name of the city. It has a fine city hall, a free public library, a sewer system, owns its own water works, has a gas, electric light and power system, a fine fire department, four banks (one of which has a paid-up capital of $1,000,000), large fruit packing-house, raisin-seeding plant, two creameries, a 100-barrel flouring-mill in course of construction, a cannery also in course of construction, a fine opera-house, a business college, a high school, an academy, grammar schools, churches of all denominations, two daily and three weekly newspapers, fine business blocks, and elegant private residences.

Winters, with a population of about 1,000, is located on Putah Creek, in the southwestern part of the county, and is noted as the earliest fruit section in the State. Immense quantities of both green and dried fruit are shipped to the East from this point. It has the distinction of growing the northernmost date palm tree in the world which fully ripens its fruit, with the exception of one at Nice, France, and that is said to be not a true date palm.

Davisville is also located on Putah Creek, and is a very fertile section of the county. There are probably more almonds grown in this section than in any other district in the State.

Yolo, a town of about 600 population, is located on Cache Creek. It is also in a very fine fruit section, and boasts of having the largest almond orchard in the world. It has an olive oil and pickling plant. The olives used for oil are first dried, and then run through a mill, which separates the seed from the pulp, the latter then being pressed to extract the oil. It is claimed that this process gives an oil of very superior flavor, and is the only mill in existence which uses this process. The olives, after being dried, can be stored away and will keep in that condition for an indefinite time, thus giving the mill the entire year in which to work up the product.

Esparto is located near the mouth of Capay Valley, on Cache Creek. It is surrounded by a fine body of land, largely devoted to fruit, vines, and alfalfa. It has a high school, a creamery, a large brick hotel, and is quite a shipping point for wheat and barley.

The towns in Capay Valley are Capay, Guinda, and Rumsey. The valley is devoted largely to fruits and vines, and it is claimed to be an equal to the famous Winters district as an early fruit section. Large portions of the valley are practically free from frost, and there are numerous smaller valleys and cañons leading into the main valley, as well as many of the hills bordering on the valley, which are also free from frost, and are adapted to the growth of anything which will grow in any part of the State.

LAND VALUES.

Prices of land range from $100 to $150 per acre for the choicest land in the vicinity of Woodland, and some of the other sections of the county most fully developed, while land a little farther away can be had for $60 to $100 per acre. Wheat lands range from $20 to $60, while good grazing land can be had at $2.50 to $10 per acre. Considering the immense productiveness of the soil, together with the other natural advantages, prices of land are not only reasonable, but are very low.

YUBA COUNTY.

Yuba County derives its name from the Yuba River, which flows along its southern border, and is bounded on the north by Butte County, south by Placer, east by Nevada and Sierra, and west by Sutter County. Its average length in a northeasterly direction is 60 miles, and in breadth varies from 7 to 30 miles, giving it a superficial area of 617 square miles, or 440,000 acres. Yuba County very much resembles Sutter County. They are neighboring counties, and the physical characteristics of the one, with a single great exception, have their counterpart in the other. The exception is that while Sutter is entirely in the plains, Yuba runs up into the Sierra, a fact which alters completely Yuba's place in the economy of the State.

Yuba County occupies a position in the heart of the Sacramento Valley. That part embraced in the angles formed by the junction of the Yuba and Bear with the Feather River, is level and well supplied with small streams. The foothill region, which reaches from the valley eastward, is at first rolling, but becomes hilly, brushy, and rocky as the Sierra Nevada Mountains are approached. The northeastern portion is rugged and broken. The land is divided about as follows, between valley, foothill, and mountain: The area of the county is 440,000 acres—valley land, 105,000 acres; foothill land, 136,000 acres; mountain, 199,000.

CLIMATE.

In the valley the wet and dry seasons are very distinctly marked, fog seldom appearing. The temperature during the day is usually high, but is cooled by the strong winds which constantly blow through the valley from the ocean on the south, and from the north by the cool air oozing down from the snow on the summit of the mountains of Siskiyou and Shasta. In summer there are a few warm days, but the evenings and mornings are invariably cool. The seasons also touch extremes which the coast belts never experience, the winter being 4° colder and the summer from 16° to 20° warmer. The thermometer during summer ranges from 76° to 90°, and in some instances reaches as high as 100° or over; but so dry is the heat that a long and hard day's work may be done in the open air without the laborer feeling any inconvenience or exhaustion.

SOILS.

The valley lands of the county are deep and rich, and of an alluvial character, entirely free from rock and stones. The valley and foothill lands are, in general, well adapted to fruit-growing, and of late years there has been a steady advance of the horticultural industries there, especially along the Feather River.

The lands in the valley, or western half of Yuba, are mostly used for the growing of grain, though most of the farmers owning large tracts have small orchards. On the east bank of the Feather River in Yuba County, where there is much rich bottom land, there are several large orchards and vineyards which are as fine as any to be found in California. The soil of the county is divided into three general classes—foothills, plains, and river bottom. The foothill land is peculiarly adapted to growing fruits. Up to a short time ago the foothill lands of this county were regarded by the settlers as almost valueless, but the success of fruit-growing on that class of land in adjoining counties, and the adaptability of the produce for long shipment, gave immediate value to them, and now lands are held at $100 per acre, and upward, which twenty years ago would not have brought more than $1. The lands on the plains are devoted principally to cereals, and there has been no failure of crop with them during the past twenty years. On this land the vine and fruit trees flourish without irrigation; however, the land could easily be irrigated, and soon will be, by means of ditches, a number of which are now in course of construction. The river lands are the best and most productive, fruit, grain, and vegetables being raised in abundance, and the income per acre is far above the general average. There is very little land in the county that can not be cultivated to great advantage, either in grain or fruit.

WATER-SUPPLY.

There is a lavish water-supply in Yuba County. There are three rivers—the Feather, Yuba, and Bear—bordering and passing through this county; each of these has numerous tributaries. Yuba was in early days one of the principal mining counties of California, and there is now a perfect network of old mining ditches which can be used for irrigating purposes. These ditches, with their tributaries, aggregate hundreds of miles. Their owners have extended many of these from the foothills to the plains below, and it is believed that these old mining ditches have sufficient capacity to carry water enough to irrigate all the arable land of Yuba County.

The average annual rainfall is between 17 and 20 inches.

THE COUNTY'S RESOURCES.

Of the area under cultivation, 38,135 acres are in wheat, 3,133 in oats, 7,450 in barley, 20 in corn, 7,459 in hay, 1,838 in alfalfa, and 990 in hops. The vine acreage is as follows: Table grapes, 45; raisin, 110; wine, 215. The number of fruit-bearing trees is 200,593; of non-bearing, 78,835.

Strawberries of splendid quality are raised in quantity. Stock-raising is also an important industry, giving every promise of drawing to it many wheat-growers in the near future.

Yuba's assessment roll for 1901 footed up $5,069,255. According to the 1900 census, its population at that time was 8,620.

The foothill portion of Yuba County lies in what is known as the "thermal citrus belt"—the natural home of the orange, the lemon, and the lime. To successfully grow such fruits, however, irrigation is necessary. Fortunately water is abundant, accessible, and cheap. Olives and the finest quality of strawberries are also grown in these valley-dotted foothills, the lands of which are worth anywhere from $15 to $25.

At present they are principally given over to stock-raising, an important and profitable industry of Yuba County, made the more attractive because stock does not have to be housed in the winter.

The Browns Valley Irrigation District, comprising 45,000 acres of choice land, is situated in the Yuba foothills, lying between the Yuba River on the south, the Honcut Creek on the north, the valley land on the west, and the foothills on the east. The mean altitude of the district is about 300 feet. Steps have been taken in the courts to dissolve the district, but the irrigation system will still remain when dissolution shall have been accomplished, private owners controlling it as a business venture, pure and simple, selling water to those who may desire it, at low rates.

It is well to note here that those engaged in growing oranges in Yuba County possess, in common with the people of the northern and central portions of the State likewise employed, one great advantage over their southern competitors. Their fruit, which is of equal quality, ripens from four to six weeks earlier, making it possible to reach the Eastern markets in time for the November and December trade, thus assuring much higher prices than can be obtained later in the season. The somewhat greater heat of the nights of the summer and fall is the cause of the early maturity.

Yuba is one of the half dozen California counties which produce hops, the fields about Wheatland being famous. The first plants were set out in 1883, the success which followed being so pronounced that now about 1,000 acres are devoted to this purpose alone, the land being worth from $200 to $400 per acre. The industry has proved a profitable one to those engaged in it.

Wheat, barley, hops, hay, fruit, dairy products, and livestock are shipped in large quantities, and can be landed in San Francisco and Sacramento in a very few hours, enabling the shippers to get the best prices. Large quantities of hay, grain, fruits, vegetables, poultry, and livestock are marketed in the neighboring mining districts.

While the lumber industry of Yuba is not of the dimensions it used to be, the county still contains hundreds of acres of valuable timber lands, and the present output of the big mill near Camptonville is considerable. The several other establishments of the kind were destroyed by fire during the past few years. The cutting of timber, however, is still vigorously prosecuted, the logs going in most cases to mills across the line in border counties.

Indications point to a much more vigorous prosecution of the mining industry in Yuba County than has been the case during the past few years.

Marysville is the county seat. Wheatland is quite a large shipping point. Other prosperous towns are Brownsville and Camptonville.

The last report of the United States General Land Office gives the area of unappropriated public land as over 63,000 acres, described as agricultural, mineral, timber, and grazing.

OFFICIAL REPORT

OF THE

Twenty-Sixth Fruit-Growers' Convention

OF THE

STATE OF CALIFORNIA.

Held under the Auspices of the State Board of Horticulture, at
San Francisco, commencing Tuesday, December 3, and
ending Friday, December 6, 1901.

SACRAMENTO:
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1902.

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TRANSACTIONS

OF THE

TWENTY-SIXTH FRUIT-GROWERS' CONVENTION

HELD UNDER THE AUSPICES OF THE CALIFORNIA STATE BOARD OF HORTICULTURE, AT PIONEER HALL, SAN FRANCISCO, DECEMBER 3 TO 6, 1901.

Pursuant to call, a convention of fruit-growers, shippers, nurserymen, and others interested in horticulture and kindred pursuits in California, assembled in convention in Pioneer Hall, San Francisco.

OPENING EXERCISES.

President **Ellwood Cooper**, of the State Board of Horticulture, called the Convention to order and explained the object of the meeting.

Rev. **George Allen**, of San Francisco, opened the proceedings with prayer.

Prof. **E. J. Wickson**, of the University of California, was chosen Vice-President.

ADDRESS OF WELCOME.

Hon. **James D. Phelan**, Mayor of San Francisco, delivered an address of welcome, as follows:

Mr. President, Ladies and Gentlemen:

It is my pleasure to welcome you to the city of San Francisco. I judge that you have selected our city as a meeting place because it is neutral territory; we do not grow here either the orange, or the lemon, or the prune; in fact, ours is a barren peninsula. A great many years ago a Spanish king sent a commissioner to California to locate the villa of Branciforte; he traveled up and down the coast, and reported on the eligibility of various places. Of San Francisco, he said there was neither water, nor wood, nor arable land, and that it was impossible as a place for human habitation; so he selected a site on the San Lorenzo

River, near Santa Cruz, as the most eligible location. San Francisco was justly condemned then as having no tillable land. The Mission fathers cultivated gardens, and had cattle and sheep grazing on our hill sides; but, apart from that, we have ever since remained, with respect to the great productive possibilities of the State, a neutral land, where, at any rate, the growers can meet on common ground without fear of rivalry.

San Francisco, without her great facilities for trade and transportation, would be of little value to the State. Fortunately, we are located on a superb bay and harbor, and the volume of freight by sea and by rail has proven us to be a shipping point for every form of productive industry.

San Francisco occupies a central position; it is a great business emporium, and we regard ourselves as in duty bound to care for the productive enterprises of California, the great sources of its wealth—horticulture, agriculture, and mining.

Recently a meeting of the California miners was held in this city, just as you meet to-day. Our city is always willing to extend every possible assistance in enlarging the markets for California products. We are aggressive and active in helping the producers who stand back of our great city and whose industry has made it great.

I was in Paris at the exposition last year, and I thought I saw there a certain market for California fruit. At the breakfast table, I ordered peaches; it was at the Hotel Reitz; and they were brought to me served on a small board with velvet pockets, and in each pocket was a peach. I ate four peaches; the bill rendered was one dollar and twenty cents. I was shown on the menu that their price was marked at a franc and a half each. Now, if it is possible to create a market in Europe for California fruits, when the prices obtained there are so very extraordinary, I am sure that the fruit industry would surpass every other industry in California. It certainly would resemble a gold mine in productiveness. There, fruit is served as jewelers display jewels, in velvet boxes!

In reading the consular reports last July, I was rather confirmed in my impression that there is a great European market for California fruits. The following translation from a Valencia paper has been received from Consul Bartleman, of that city, under date of April 10, 1901:

> Spanish products are rapidly losing ground, and, unless our methods be brought into line with those of progressive nations, our wines, our oil, our fruits, and our vegetables will be condemned to home consumption. We have been astonished at the falling off in our exports of fruit and fresh vegetables to France, England, and Germany. The decrease for France, notwithstanding the enormously enlarged consumption created by the Paris exposition, was erroneously attributed to Italian competition. The rivalry really comes from the United States. California is now supplying the French, English, and German markets with fresh fruits and vegetables. The fruits are not offered at lower prices than our own, but they are presented neatly packed and in splendid condition.

> It is ridiculous to think that fruits and vegetables raised on the slopes of the distant Pacific should compete at the very doors of Spain with those produced in this country, yet the fact is undeniable. How is the mystery explained? It is simply this: Spain sends her fruits and vegetables in the worst possible condition, so far as packing and transportation are concerned; piled on wretched railway cars, exposed to sun and rain, and reaching Paris from fourteen to seventeen days after their departure from Valencia; while the Californians offer their fruit in the same fine condition in which it is picked from the trees. Their oranges, apples, peaches, and pears reach Paris, after traversing 6,000 miles, in a more attractive and appetizing condition than ours after a journey of only 490 miles.
>
> We can compete with America only by employing her methods—improved cultivation, harvesting, and packing, cold storage, and rapid, safe transportation. Otherwise, our exports will decline every day. Castile was once called the granary of Europe; yet we have lived to see foreign wheat, after paying heavy transportation taxes, protective duties, and an adverse premium of thirty-five per cent in exchange, competing with our home-grown cereals. Shall we live to see American oranges competing with ours on the Valencia market itself?

Now, that is very interesting if you are not already familiar with it, because it shows the possibility of enlarging the markets for our fruit, which, of course, determines the prices of fruit.

By the construction of the Nicaragua Canal, some seriously contend that the trade of the Orient would pass by San Francisco and that possibly we would suffer, but California's resources will be increased when the market facilities are increased. In using the Nicaragua Canal, by which a distance of 10,000 miles will be saved in reaching remote markets, transportation charges will certainly fall, and we can send shiploads of our products to the great markets of the world. The people in the oriental lands will also independently be brought to appreciate our products. Together with this, on the eastern coast and in northern Europe, dwell great populations, and they can be more easily reached by a facilitation of the transportation offered by the completion of this canal.

California has that of which Spain, Italy, or France can not boast—variety of products. This is an element of safety, for if one fails, another will yield. Considering the State collectively, we are thus always protected, though here and there an individual may suffer. We must not lose courage on account of frost or scale, because those ills will find their remedies. Science will devise means, as it has for protecting the vine in France.

A former Mayor of this city, Frank McCoppin, as United States Commissioner to Australia, introduced the *Vedalia cardinalis*, or ladybird, which has done so much in California to destroy insect pests. Now, it is proposed to turn our cannon against Jack Frost.

I have a report from the United States Consul at Lyons, in which he says that they have discovered in France how to prevent frost by the discharge of cannon. If we can use our army and its great guns for the purpose of preventing frosts, it, I am sure, would appeal very strongly to the producers of this country. [Laughter.] We can then afford to support our military establishments in time of peace. He says:

> The last number of the Gironde, a Bordeaux newspaper which represents the winegrowers of that region, contains an article by M. Bellot de Minieres on the subject of preventing frosts from injuring early fruit. His theory is that it is not the frost which blasts the budding fruit, but the sun's rays following a night of frost and finding in the grape, already sensitive from the cold, an object unable to withstand their heat. After many experiments, which he says have always succeeded, M. Bellot de Minieres recommends the accumulation, at various points in the vineyard, of combustible matter, capable of producing a thick, black smoke, and setting fire to these heaps of fuel at sunrise, so that a veil of smoke may cover the entire ground, protecting the vine by its opaqueness against the sun's rays and maintaining the general temperature of the vineyard at a point which will counteract the effects of the frost. The smoke, which acts as a warm blanket, lifts gradually enough for the vine to adapt itself to the changed temperature.
>
> Since I reported on the subject of firing cannon for the prevention of hailstorms, the use of cannon for other allied purposes has been discussed in agricultural circles. Dr. Marangoni, professor of physics at the Royal Lyceum of Florence, Italy, has declared his belief in the efficacy of the use of cannon for the prevention of frosts. He says: "There are astonishing resemblances between the state of the atmosphere which produces hail and frosts. * * * An absolute calm is necessary for both. * * * In the phenomena of the white frost * * * the calm creates a very cold layer of air near the surface of the earth, saturating the otherwise dry air, and at the coldest moment the frost is formed. * * * The important object to be achieved in the case of both hail and frost is to break up the calm before either is formed."
>
> He recommended that the cannon be fired horizontally over the ground to be protected. Under his direction, cannon were fired horizontally over the vineyards of Count Balli, at Asti, and he relates that a strip of vineyard five hundred feet wide over which two cannon were fired was entirely protected, while the vines on each side were badly injured by the frosts.
>
> At the central office of the agricultural societies in this part of France, I was told that extensive preparations are being made to test the efficacy of cannon against frost this spring.
>
> One of the gentlemen who is working on this question said to me: "The frost is formed by the stored heat of the sun combined with an excess of dampness; * * * the firing of the cannon produces perturbations in the atmosphere, causing a slow transition between the coldest hour of the night and the coming of the heat of the sun."
>
> It has just been determined to hold an international cannon congress in Lyons next November, in which this subject will be fully discussed, and I am requested to say that American representatives are invited to be present and to take part in its deliberations.
>
> As an invasion of grasshoppers is announced for this summer in southern Algeria, cannon are to be tried against them also.

I have read that report with interest and desired to communicate it to the Convention, but knew of no better way than to communicate it myself. It is hardly within the lines of an address of welcome, but we of the city are your friends, your interests are ours, and we follow the work that interests you. We will contribute in every way possible to the success of your deliberations, and bid you again a cordial welcome. [Applause.]

Upon motion, the thanks of the Convention were extended to Mayor Phelan by a rising vote.

PRESIDENT COOPER'S ANNUAL ADDRESS.

This is the twenty-sixth State Fruit-Growers' Convention, and the twenty-second held under the auspices of the State Board of Horticulture. A brief review of the year's results in the fruit crops in the different localities of the State encourages the belief that greater prosperity exists than for several years past. The deciduous fruits in the northern and middle portions have brought good prices, especially for the cured product. The orange crop in the southern portion has been good, and the prices realized also better than for the past few years. The lemon industry was much depressed by excessive importations. The walnut crop was a fair average, and the prices higher than for many years past, excepting the previous year (an advance obtained by reason of a small crop). The prune crop has not been marketed successfully; nor has the raisin crop; and it is to be regretted that the best efforts and the best minds striving to coöperate in the disposal of these fruits have not been united. Differences regarding the management have caused dissatisfaction and dissension, which is greatly to be regretted and is a serious detriment to the success of the growers.

The question of marketing fruit has the largest place on our programme, and the many essayists who will treat this subject will no doubt explain every phase of the difficulty; and I hope that the final outcome will harmonize the various opinions, and that we will arrive at the most complete system of coöperation, which will give satisfactory results.

To quote from an experienced fruit-grower: "We know the soils best adapted to various fruits; the best varieties to plant for family use and commercial purposes, and know how to evaporate them. We have also learned what varieties to plant for pollinating purposes. We know most of the diseases and insects infecting trees and fruit, and how to combat them. But the marketing of our products to advantage is the greatest problem that confronts us. We have plenty of growers who can produce the very best fruits ready for market, but there their generalship ends. To place these goods in the world's markets at a profit to themselves is a feature they have never studied, and therefore are not able to execute the plans they have so carefully prepared. It requires a thorough commercial training to do this special work."

INSECT PESTS.—The losses sustained in combating the noxious insects that infest the fruits and fruit trees are as great, if not greater, than from improper distribution and bad marketing of the fruit products. According to an estimate of the average expense by the fruit counties, it amounts to $300,000 annually. This does not include the loss caused by the ravages of the pests. In the artificial remedies applied there is from year to year no decrease in the cost, but rather an increase, so that as long as the fruit-growers rely upon such remedies it is likely to be a perpetual tax on the industry. If, however, we bend our energies in the line of combating these pests by their natural enemies, very soon all this loss and expense would disappear. In our experience we have had ample proof that combating these noxious insects by their natural enemies is the only method that can be relied upon to give us relief. We have expended in this direction, in the first voyage of Albert Koebele, $2,200, paid out of the appropriation of $50,000 by the United States Congress to advance the American interests at the exhibition at Melbourne. In Governor Markham's administration $5,000 was appropriated. In Governor Gage's administration $7,500 was appropriated. In these expenditures of less than $15,000 during a period of thirteen years (Report 1891, p. 290), many millions were saved to the fruit-growers of California; also, through our experience an equal amount in South Africa, Hawaii, and other places.

As an incident the Hawaiian Government had such confidence in the result of Mr. Koebele's researches, that they secured his services at more than twice the salary paid to him while in the service of California. Immediately on securing the $7,500 appropriation the State Board made application to the Hawaiian Government to procure the services of Mr. Koebele, and were told by that Government that California had not money enough to get Mr. Koebele. The State Board employed Mr. George Compere, and by exercising the greatest economy kept him traveling nearly two years. During this period, eighty-five strong colonies of scale and aphis destroyers were received and liberated in seventeen counties. Among these was the smallest ladybird known, the destroyer of the red spider, and fourteen colonies of internal parasites of the black scale. Among the number was the parasite of the grasshopper, and probably the most important was the parasite of the red scale, sent from China, and which we believe is permanently established in Southern California.

I will not, however, take further time in mentioning the particulars of the results of Mr. Compere's searches, but refer you to the detailed report of Alexander Craw, our quarantine officer, to be presented at this meeting. Before leaving this subject, however, I will state that the Australians were so interested in the work of Mr. Compere that he has been made a member of the Board of Agriculture of West Australia, and is working for that country on the same line of investigation as he did for us. It is not remarkable that these countries mentioned—Hawaii, Australia, and South Africa—have taken such a deep interest in the search for parasitic insects to destroy fruit pests, but it is most remarkable that California, having probably ten times the interest, should not have kept up a permanent appropriation to continue so important an investigation. We have found continued opposition by the Department of Entomology at Washington and by the entomologists of New England and the Middle States. In correspondence with the State Board of Agriculture of Massachusetts concerning the gypsy moth, that board was requested to set apart $5,000 from an appropriation of $250,000 and send an entomologist with our searcher to look for the natural enemy of this moth, which is known to exist in northern middle Japan. This was refused, and the names given of seven entomologists of New England, New York, Pennsylvania, and New Jersey, whose advice was against the proposition. They have spent a million of money in trying to stamp out the gypsy moth, and yet the territory of its ravages is extending.

Irrigation.—There has been so much written and published on this subject in the past two years, that I will not dwell on it, but refer you to my opening address of one year ago, and also call your attention to the appeal of the National Irrigation Association; headquarters at 1707 Fisher Building, Chicago; George H. Maxwell, executive chairman. His appeal is to all those interested in the subject to become members of the association by contributing annually five dollars, which will entitle them to all the publications, and to organize in each district and to instruct our representatives in Congress to favor a national system. The executive chairman asks for the indorsement by this Convention of the principles advocated by the association.

Forest Protection.—This question goes hand in hand with irrigation, and is a part of the appeal above mentioned. On this subject I refer you to my remarks made at the Fresno convention.

Food Adulteration.—I call your special attention to my remarks of one year ago. This subject is claiming the attention of many of the States, and the most severe laws have been enacted to protect the consumers in the quality of foods placed on the market for sale. I call your attention to what has been done in the State of New Jersey, where thousands of dollars have been appropriated to ferret out and to punish offenders who have on sale adulterated articles or substituted articles of food products without proper labels. The adulteration and substitution of food products concern the industries of California more than those of any other State in the Union, and yet not one dollar has been appropriated to protect those industries.

We have on our statute books a dairy law, an olive oil law, a drug law, and a pure food law generally, also a horticultural quarantine law to protect us from new diseases, etc. Regarding the latter I beg to quote from a very able opinion given by Judge John F. Ellison in a suit brought in Tehama County. He said: "It is a crude and unsatisfactory mass of legislation upon a very important subject. The fruit industry is one of the largest and most important in this State, and it would seem that some plain, simple legislation upon so important a subject should be formulated and passed."

Regarding the olive oil law, Judge Torrance, of the Superior Court of San Diego County, in a test case appealed from the Police Court, decided that the sections of the statutes making it unlawful to substitute any inferior or cheaper article whatever, wholly or in part, for another, or to sell one article under the name of another, are unconstitutional.

The Sacramento Record-Union on July 11th published as an Associated Press dispatch from the Union of San Diego, that former State Senator D. L. Withington stated that under the amended pure food law the word "manufacture," which was in the old law, was omitted, and that the words "knowing" and "knowingly" have been inserted in the new act, so that the prosecutor must prove that the seller of an adulterated product had knowledge that it was adulterated when he made the sale—a fact not ordinarily susceptible of proof. It seems to me that these laws should be revised by some competent attorney so as to overcome or remedy their defects, and a mode be devised of sampling foods offered for sale, and analyzing them and prosecuting offenders, with an ample appropriation to insure the relief which was intended.

CLEOPATRA'S NEEDLE.—In my opening remarks at the Convention held one year ago, I recommended that an effort be made to remove Cleopatra's Needle from Central Park, New York, and set it up in Golden Gate Park, San Francisco, giving my reasons why this should be accomplished (see pages 80–82 of the Report for 1900). A resolution was passed referring the matter to the California State Board of Trade and the Park Commissioners. No action has been taken by either, so far as any report to the State Board of Horticulture. My enthusiasm to secure the greatly-desired object has not abated. There are several important localities in the State where the obelisk could be set up, and since San Francisco has practically done nothing the matter should be taken up by a committee of fruit-growers and farmers, who could ask for bids from various localities for its possession, and an additional sum, if it should be necessary, could be donated by the fruit-growers and farmers to meet the expense.

RECOMMENDATIONS.—I will not discuss further in this paper the matters that are coming before this Convention, but before concluding will recommend:

First—That we pass a resolution, to be sent to our members of Congress, that we object to and will oppose any reduction in tariff duties on fruits and fruit products by reason of reciprocity considerations.

Second—That we urgently request that a route for an interoceanic canal be selected, the work to be commenced and the final completion to be consummated at the earliest possible moment.

Third—That we re-introduce a resolution setting aside from settlement our mountain lands, as passed two years ago at the San José Convention. (See Report, page 138.)

Fourth—That there be appointed a committee of fruit-growers and farmers to take up the matter of removing the New York obelisk to California.

Fifth—That there be appointed a committee to take up the subject of California's horticultural exhibit at the exposition to be held in St. Louis in 1903, and report the same at the next Convention.

Regarding resolutions to be presented to the California Legislature, I would suggest that they be deferred until our next Convention, to be held in November or December, 1902. The next Legislature will not convene until January, 1903. The better plan would be to appoint committees to formulate resolutions to be presented at the next Convention for confirmation, or to instruct the Executive Committee of the State Board of Horticulture to have such resolutions formulated for presentation. Subjects to be acted upon:

First—An appropriation of $10,000 for the investigation of parasites and predaceous insects and the procuring of same to destroy noxious insects, for distribution in California.

Second—Our quarantine laws to be simplified and improved, as suggested by Judge Ellison.

Third—Our pure food laws to be revised and amended so as to be operative, and a mode devised to carry out the object, with an appropriation that would insure active work in the line of establishing true labels on all food products.

All these matters are respectfully submitted for your consideration.

Upon motion, A. H. Naftzger, B. N. Rowley, E. J. Wickson, H. P. Stabler, and W. J. Hotchkiss were appointed a committee on the President's address.

REPORT OF THE CALIFORNIA FRUIT GROWERS AND SHIPPERS' ASSOCIATION.

By H. WEINSTOCK, President.

Season's Shipments.—The following is a summary of the results of the season's shipments:

Cherries.—The crop of cherries during the past season in California was very light, there being less than half as many carloads sent East during the season just closed as during that of one year ago. The quality of the fruit was generally good, in fact superior to that of the preceding season, and excellent prices were realized.

Peaches.—California had a very good crop of peaches, as is evidenced in the fact that over 500 more carloads were sent East during the last season than during that preceding it. While early peaches realized fine prices, not until the latter part of August, when a tremendous crop of Eastern peaches was marketed, did a "slump" occur. With the exception of Salways and a few of the later varieties, splendid prices prevailed on peaches, netting very satisfactory returns.

Plums and Prunes.—Only a fair to light crop of plums and prunes was harvested, the output of these being nearly twenty per cent less than for the preceding year. Owing to the marvelously fine prices ruling on California plums and prunes during the entire season, it is safe to say that very nearly everything obtainable under this head was shipped East, with satisfactory results.

Pears.—The pear crop of the State was an average one, although the records show a falling off of about 600 cars as compared with the shipments of last year, the crop of which, however, was unusually large. The prices obtained for good pears were particularly satisfactory, there being no "slump" or weakness in the Bartlett pear market at any time during the season.

Grapes.—The State produced an average crop of grapes. The shipping records will show an increase of over 150 cars for Eastern shipments. This, however, is not due to a larger crop, but more directly to climatic conditions, the weather during the closing days of the season being particularly favorable for grape shipments, permitting growers to move nearly their entire crop—as one grower expressed it: "shipping everything down to the roots." The prices on grapes were also good.

Apples.—A large crop of apples was produced, which has been going forward for some time, and is still actively rolling. Owing to a light Eastern crop, the demand from that section has been brisk. The entire apple crop of the State will be moved at very satisfactory prices, and in advance of previous seasons. Over 1000 carloads will go forward from the Watsonville section alone during the present season, showing an increase of one hundred per cent over last year's shipments.

RAILWAY SERVICE.—There was a marked improvement in the railway service during the early part of the season over last year; but on the whole it did not come up to expectations. Up to about the middle of August fruit was delivered to Chicago in 7 days, to New York, Philadelphia, and Montreal in 10½ days, and to Boston in 11 days; but later in the season it was about 9 days to Chicago, 12 to 13 days to New York, Philadelphia, and Montreal, and 13 to 14 days to Boston. As near as can be determined, the greater part of the delays was west of Chicago. In the early part of the season the Southern Pacific Company landed cars in Ogden from Sacramento within 60 hours—later it took 72 hours—while the Union Pacific also made 12 hours slower time at the close than at the beginning of the season.

The experience during the early part of the season made it plain that the Western roads can deliver to Chicago in 6 days. When this is done, New York, Philadelphia, Montreal, and Boston can be reached in 9 or 10 days.

REFRIGERATOR CAR SERVICE.—The refrigerator car service for the season was eminently satisfactory. No shortage of cars occurred at any time, and shipments received careful attention.

EXTENSION OF MARKETS.—There is room for further development of markets for California fresh fruits. This matter, however, rests largely with the transportation companies. If they will deliver to Chicago in 6 days, and to Atlantic points in 9 or 10 days, it will insure the arrival of fruit in a condition to permit of its re-shipment in less than carload lots to minor points. With the time consumed during the latter end of this season, it became extra hazardous to re-ship to minor points. The fruit must, therefore, be consumed at the point of arrival, thus limiting the possibilities for developing newer and smaller markets. This fact should be brought to the attention of the railroad authorities, in the hope that they will make every effort to give the service needed to secure the broadest results for the sale of California fresh fruits.

PACKING.—While there is room for still further improvement in this direction, it is gratifying to note that there has been less complaint this season of poor packing than ever before. More attention than ever is being paid to this matter, and growers are fast learning that it pays, and pays well, to give the Eastern buyer honest, careful, and sightly packing. It is hoped that the growers of California will strive to win the reputation of being the finest packers of fresh fruits in the world. Such a reputation in itself will add to the value of California fruits. Buyers will have less hesitancy in buying from samples and more confidence in getting what they have a right to expect.

PRICES.—Excepting late peaches, prices for the season on all fruits averaged about twenty-five per cent higher than last year. This improved result is the outcome of several favorable conditions: (*a*) Better railway and refrigerator car service; (*b*) A lighter crop of Eastern fruits; (*c*) More care in selection of fruits; (*d*) Better packing; (*e*) The reduction made by the Southern Pacific Company of from 26,000 to 24,000 pounds minimum to the car. This made better refrigeration possible and aided the fruit to arrive at its destination in better condition.

Late peaches did badly, because of too many being shipped at the time when the Eastern crop was being marketed. In this connection I beg to refer to my last year's report, in which I said: "This year's experience has made plain that, so far as peaches are concerned, whenever the Eastern States have a full crop, it is unprofitable to send any but the very finest peaches, of good keeping qualities. The balance should be retained at home and canned or dried."

SUMMARY.—On the whole, this has been one of the most favorable years in the history of the California fruit industry. The results can not but have added very much to the value of California fruit lands, and to have inspired the fruit-growers with renewed courage and hope in the future.

With the growing experience and higher judgment that is being exercised on the part of the grower in the planting, cultivating, harvesting, packing, and marketing of his crop, the outlook was never brighter for the future of the California green fruit industry.

Table Showing Destination and Number of Cars Shipped to Each Place in 1895, 1896, 1897, 1898, 1899, 1900, and 1901.

Destination.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Chicago	1473	1007	1410	1203	1060	1101	1273
New York	862	1055	1456	1429	1694	1527	1482
Boston	279	471	543	536	710	649	639
Philadelphia	82	90	202	176	339	212	257
Minneapolis	124	147	180	167	247	302	275
Baltimore	37	5	16	16	67	34	23
Cincinnati	15	2	20	15	89	35	29
Kansas City	91	81	86	116	165	129	85
Montreal	44	81	98	96	128	126	128
New Orleans	75	85	81	62	126	136	118
Denver	148	136	98	229	269	233	246
St. Louis	78	68	59	27	115	79	64
St. Paul	109	91	121	67	125	131	108
Omaha	176	85	165	156	194	240	205
Cleveland	29	10	37	25	83	63	58
Pittsburg	26	25	40	47	137	144	167
Buffalo	15	7	15	5	34	10	32
Milwaukee	42	32	52	19	60	68	62
England	------	42	58	42	117	192	93
Scotland	------	------	------	------	4	7	16
Germany	------	------	------	------	2	------	------
Mexico	------	------	------	1	1	------	1
Minor Points—Canada	------	------	------	------	52	71	55
Minor Points—United States	863	532	586	572	1051	946	1043
Totals	4568	4052	5323	5007	6869	6435	6459

Table Showing the Number of Cars of Each Variety Shipped in 1895, 1896, 1897, 1898, 1899, 1900, and 1901.

Varieties.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Pears	1187	1624	1640	1595	1684	2115	1535
Peaches	1289	976	1316	1103	2625	1361	1901
Grapes	1010	712	1100	734	847	825	966
Plums and Prunes	465	407	742	542	885	1158	936
Apricots	162	172	177	123	90	152	201
Cherries	180	88	239	297	85	238	110
Apples	105	53	61	596	490	512	739
Quinces	13	8	24	1	19	10	13
Figs		2	3				
Nectarines	5	1	10		2		2
Persimmons			2	1	1	3	2
Mixed	152	9	9	15	24	27	23
Cars not reported					117	34	31
Totals	4568	4052	5323	5007	6869	6435	6459

Upon motion of R. D. STEPHENS, the report was received and placed on file.

REPORT OF COMMITTEE ON FOREIGN CONSULAR ADVICES.

MR. EDWARD BERWICK, Chairman of the Committee on Foreign Consular Advices, presented the following report, which was received and placed on file:

On the re-appointment of your committee at last year's convention, Mr. E. F. Adams kindly undertook a correspondence with Senator Perkins and Secretary Hay, which eventuated in Secretary Hay undertaking to instruct the Consular Service to obtain such information as to fruit crops, prices, stocks, etc., as the fruit-growers wished. With some difficulty and delay it was ascertained just what were the fruit-growers' wishes in detail. These were duly communicated to the Secretary of State.

Mr. Adams, finding the correspondence required too great a demand on his time, interested Mr. Eugene Goodwin, of the Pacific Commercial Museum, in the matter. This gentleman not only completed successfully the work so ably begun by Mr. Adams, but formulated a special cable code, and the Pacific Commercial Museum has thus far borne the expense of all cablegrams.

Your committee deems that it would be right for this Convention to request our representatives in Congress to arrange for this expense in future to be included in the appropriation for the Department of State.

It also seems desirable that the service should be so extended as to include reports as to apples and pears, seeing the growers of these fruits far outnumber all other fruit-growers and are found in every State of the Union.

Those desiring further information of the work of the committee are referred to the correspondence appended hereto and made a part of this report.

MR. BERWICK. Mr. President, if you will appoint a time, Mr. Eugene Goodwin will appear here and discuss the subject-matter contained in this report.

PRESIDENT COOPER. We will hear Mr. Goodwin at 2 o'clock this afternoon.

REPORT OF COMMITTEE ON NICARAGUA CANAL.

MR. EDWARD BERWICK, chairman, presented the following report of the Nicaragua Canal Committee, appointed at the last Convention:

The resolution respecting the Isthmian Canal, passed at your last Convention, was duly forwarded to your representatives in Congress.

During the past year the Isthmian Canal Commission has completed its investigations, and sent in its final report to the President. That commission definitely recommends the Nicaragua route, as being the most feasible and practicable one. It remains for the Congress now in session to take action as speedily as may be on that recommendation.

The inability of the present transportation companies, as shown in the past year, adequately to handle even the present amount of our rapidly increasing produce, not only accentuates the need of the canal, but leads to the hope that they may withdraw their opposition to the project; which opposition has notoriously been in the past the main bar to satisfactory congressional action.

After the obsequies of the lamented President McKinley, your committee wrote to President Roosevelt, urging him to employ his strenuosity in thwarting the machinations of opposing corporations, and obtaining the abrogation of the Clayton-Bulwer treaty. The letter was referred by the President to the Secretary of State for his due consideration.

Your committee would respectfully suggest that all friends of the canal should redouble rather than reduce the amount of energy they can expend in agitating the prompt construction of the canal.

Obviously the powers of resistance offered by a $2,000,000,000 aggregation of capital is twenty fold greater than that presented by one of only $100,000,000.

The report was received and placed on file.

MR. BERWICK. I have in my pocket here the interim report of the Walker Commission. I have always borne the canal in mind, as most of you have, as a thing we all need and have needed for a long time. I don't think we always realize our importance as makers of history in these great matters. You all know that commerce is the conquering power of the day. What is the foundation of commerce? It is not the merchant; it is the producer and grower of fruit; and this being a fact, the California fruit-grower is a heavy factor in the commerce of the United States. It occurs to me that we do not feel important enough. We have made history to the tune of somewhere in the neighborhood of 16,000 carloads of fruit in 1890. Our entire product in fruits, vegetables, and things of that sort last year was 66,000 carloads. What are those carloads worth, together with the boxes and transportation? Shall we call them $500 a car? At these figures you will see that we have, in the last ten years, added an immense sum to the State's production—we have added this to the commerce of the State. I say commerce rules the world to-day, and I think we fruit-growers should feel that it is important that we should meet often and talk these matters over, and that we have a right to address our President and our representatives in Congress in our efforts toward the completion of the Nicaragua Canal. It means rapid transit to Europe; not only that, but cheap transportation and an easier ride for our fruit. You have all been on freight trains. Sometimes it jars you, and jars our fruit, too, before it is ready for the "jars." The steamboat does not do anything of this sort. God's highway is a very smooth highway for fruit to travel over. You put your fruit in the steamer on cold storage, and it goes wherever you want it to go without a jar. The Nicaragua Canal renders that thing possible.

MR. ADAMS. I would like to call your attention to one matter that no one has ever succeeded in getting the public on this Coast to take hold of. I presume that you are all familiar with the fact that in the coast-wise commerce (ships passing between one port and another in the United States) none but American ships are allowed to engage. The important thing for us to get is cheap rates through the canal between our American ports—between the Pacific and the Atlantic. Home markets are the best markets we have. This market of California and the Pacific Coast is worth more to the people of the Atlantic Coast than any other market they can get. What we ought to have is reduced rates on coast-wise commerce. As yet the people have never got hold of that part of the question. Carefully reading the text of the treaty leaves me in doubt whether, under the treaty, there can be any rebate on the coast-wise trade as it now stands.

MR. BERWICK. I supposed there was none. If this was extended to the East, we could ship East and the East could ship to us at the reduced rates. This is a matter of the most importance to the fruit business. It is to the sailing ships that we may look for the greatest reduction in freights and for better time.

AFTERNOON SESSION—FIRST DAY.

TUESDAY, December 3, 1901.

The Convention was called to order at 1:45 o'clock.

President COOPER announced the following Committee on Resolutions: W. H. Aiken, B. N. Rowley, B. E. Hotchkiss, B. G. Hurlburt, Leonard Coates.

FRUIT OUTLOOK IN THE SAN JOAQUIN VALLEY.

BY I. H. THOMAS, OF VISALIA.

I received some time since a letter from your Secretary, Mr. Isaac, asking me for a paper to be read at your annual convention, upon "The Future Outlook of Deciduous Fruits in the San Joaquin Valley." I consented to write such a paper, provided Mr. Isaac would allow me to add the citrus industry to the paper. This he did.

In 1893, while a member of the State Board of Horticulture as Commissioner for the San Joaquin Valley, I made a report of the then conditions of deciduous and citrus fruits in this valley, taking up each county from San Joaquin to Kern. This report was published in the Fourth Biennial Report of the State Board of Horticulture for 1893 and 1894.

Since that time there have been a great many changes made in the planting of deciduous fruits in this valley. Where mistakes were made in the planting of wrong varieties, orchards have been rooted up and leading varieties planted; and in many instances where irrigation brought the alkali to the surface too strong for stone fruits, trees have been taken out and pear trees substituted, and they are now producing profitable crops. The present outlook in the valley for deciduous fruits was never better, as irrigation systems have been extended, bringing large quantities of good lands within reach of water. The mode of irrigating with pumping plants is now coming to the front, so that anybody with a twenty or forty acre tract of land can put in his plant and go to sleep at night without being haunted in his dreams with suits of riparian owners and assessments for water.

The discovery of oil in this valley solves the question of irrigation for the orchardist, as it has made it possible for him to have water the year round. All he has to do is to turn on a small stream of crude petroleum and start his pump, at the cost of only six cents per horse power per ten hours.

At our district fair, held at Hanford in October, Mr. R. G. White, of that city, had the Daniel Best crude-oil engine on exhibition. This was an eight-horse power engine with three pumps attached, running at an expense of only forty-eight cents for ten hours, using only twelve gallons of Coalinga crude petroleum each ten hours. For each additional horse power it takes one and a half gallons of oil for ten hours' run. This oil costs, laid down in Hanford, four cents per gallon, or about one tenth of what it would cost to run with steam.

The completion of the canals around Modesto and Turlock has made it possible for thousands of families to secure good homes on lands that are easily worked, and with water are very productive, growing anything in the fruit line that may be planted thereon. It is the writer's opinion that some of the best olive lands in the State are in this section. Merced and Madera, as well as Fresno, are also well to the front in the growing of deciduous fruits.

I have not the statistics of the shipments of fruits from Fresno this season, but the output is very large and has been quite profitable to the growers, as well as giving employment to thousands of men, women, and children in the canneries and packing-houses.

TULARE COUNTY, the home of the peach, nectarine, and prune, has had a prosperous season, and the growers have done well in shipping green fruits East, as well as supplying canneries in other parts of the State.

The Visalia cannery this season used 3,178 tons of peaches, and our dried prune output for the season is 7,280,000 pounds. To substantiate the claim that this county can grow more prunes to the acre than any other portion of the State, I will mention one orchard (the Togni orchard, near Visalia) of 39 acres, that averaged this season 342½ pounds of green fruit per tree, and the cured product 4 tons per acre. This orchard is six years old.

The shipments of green fruit East from this county this season have been 275 cars, realizing to the grower from $75 to $150, and on Tragedy prunes, $200 per acre. Of dried fruits (aside from prunes), the amount shipped is about 50 cars, at prices satisfactory to the grower.

A large quantity of our grapes has gone to the wineries and thus made it possible for raisin-growers to all come under the same umbrella (which they have not done) and get good prices for their crops.

The producing capacity of our soils does not seem to be depreciating, as I have reliable statements of sixteen tons of Thompson's Seedless and Sultana grapes being harvested per acre in the Dinuba and Orosi districts.

KERN COUNTY has been carried away with an oil excitement, and orchards and vineyards have been neglected, though there are thousands of acres of as good fruit land in that county as there is in the State.

Kings County.—This county is well to the front in deciduous fruits, and still has a large acreage of deciduous fruit lands yet unplanted. The growers had fine crops this season and received fair prices. The great problem that now stares them in the face, as well as the growers of other counties in this valley, is the pear blight, which looks as if it will destroy the pear industry in this valley. The eradication of this pest or disease, or explaining what it is and providing a remedy for the same, is far beyond the brain capacity of the ordinary county horticultural commissioner, and if immediate help does not come from our State Board of Horticulture or from university professors, there will be a great loss in this valley by blight.

In conclusion of my remarks on the deciduous outlook would say that the chance for making money in this valley out of deciduous fruits is as good now as it ever was. The planter now can profit by the experience of others, knowing just what to plant to supply canneries and Eastern shipments, as well as to grow the best drying product. With our facilities for irrigation, the planter should not now make a failure.

Citrus Fruits.—Now as to our citrus industry. I will not weary you, but will give you a brief mention of the principal localities where orchards are now in bearing.

The citrus belt of the San Joaquin Valley commences in Kern County and occupies the thermal belt of the west slope of the Sierra Nevada Mountains to the northern part of the State. The planting of citrus trees for profit first commenced on a small scale at Porterville about the year 1888, and the first carload was shipped from that place in 1891. At this writing there are 800 acres planted to oranges and lemons, with a shipment of 325 cars from the Porterville station for the present season's crop. The water for irrigating this section comes mostly from Tule River, though many of the orchards are irrigated from pumping-plants, there being no difficulty in getting water at a minimum cost.

In 1888 the Lindsay Land Company purchased 2,000 acres of land where the town of Lindsay now stands, and incorporated, with Captain Arthur J. Hutchinson as manager. The company at once commenced the improvement of its holdings, and now has planted in that district 1800 acres. The first shipment from this place was in 1896, when 10 carloads were shipped out. This season the crop will amount to 300 cars. The orchards in this vicinity are in small holdings, which are irrigated by water from pumping-plants supplied by the Lindsay Water Development Company. This section of Tulare County is underlaid with plenty of water, at a depth of from 40 to 100 feet, and power is furnished by the Kaweah Electric Power Company. There is an abundance of water for all and during all times of the year. Besides the Lindsay Land Company, other companies have and are now opening up large tracts of land around Lindsay, and are meeting with success in finding water. Messrs. Hammond & Wishon have two large tracts, consisting of 500 acres, which are cut up in small holdings, with water developed to cover all the land.

One of the chief points in the oranges grown in this section is, that while they do not show much outward color when picked, the meat inside is well colored, sweet, and full of juice, causing them to color readily when packed, without shrinking, as many oranges do when gathered green. Lemons from this section, even on November 21st, at public auction in New York, brought $1 per box more than imported lemons.

The area now planted at Exeter is about 1800 acres, in large holdings, and the shipments from there this season will be 175 cars. This section is mostly irrigated from a ditch taking water out of Kaweah River, some 12 miles northeast of Exeter, though they do not rely altogether on the ditch, and have wells and electric power to resort to when the water is low. At one point here the water is forced up on a mountain to the height of 500 feet, where several hundred acres are being planted in a belt that is absolutely frostless, the temperature being 15° higher on the mountain side than at the base. Citrus trees along the base of the mountain come into bearing very young. As an instance, Mr. Griffin has a two-year-old orchard here that will yield a carload this season, some trees with a half box of merchantable fruit on them.

The Bonnie Brae orchard, managed by Mr. George Frost, being the oldest orchard here, is making the most of the shipments this season, though Mr. Moore and Mrs. Newhall have orchards that are almost paying for themselves in this season's crop.

Lemon Cove, some ten miles northeast of Exeter, has 480 acres planted to citrus fruits, mostly lemons, to which fruit the soil is best adapted, and I have no hesitancy in saying that there is no place in California that can produce a better lemon than this section, which fact has been demonstrated by analysis. The shipments of lemons alone from this point this season will be 80 cars.

Antelope Heights, situated on the north side of the Kaweah River, is a new development, and there are about 300 acres planted, the trees now being one and two years old. The orchards are in small holdings, and are irrigated by pumping-plants with an inexhaustible supply of water. This section will never be bothered with frost, and is destined to be one among the best localities in the valley for citrus fruits.

East of Sanger and Reedley, in Fresno County, there are about 1600 acres planted to citrus fruits, the trees mostly one and two years old. The shipments from this section will be about 40 cars.

Along the foothills in Madera, Merced, Stanislaus, and San Joaquin counties, there are thousands of acres of citrus lands, which need only water to make them profitable.

In conclusion I will say that the localities I have spoken of in this paper are, to my mind, not to be excelled in this State for citrus-growing. They are free from scale, as the climate is such that many of the scales that infest other parts of the State can not live here. Our oranges catch the early Eastern market, when top prices rule.

A parting word to the fruit-growers present: California grows the best fruits in the world, and the world is beginning to want them. Now, can not you, as growers and as intelligent men, get together in some kind of an organization and market your fruits, both green and dried, so as to make the business more profitable than it has been? Can not you make the umbrella large enough to take all the growers under its protection, and not leave thirty to forty per cent outside to cut your throats?

The address of Mr. Thomas was received and placed on file.

DISTRIBUTION OF FRUITS.

By A. H. NAFTZGER, of Los Angeles,
President and General Manager of the Southern California Citrus Fruit Exchange.

Probably in no other class of products from the soil has there been so great increase in volume in recent years as in fruit-growing. The shipments from California orchards alone have increased from 16,000 carloads in 1890 to more than 66,000 carloads in 1900—an increase of more than 400 per cent in ten years. The census reports are not yet complete, but the advance bulletins indicate a similar vast increase in fruit-growing in every part of the country. As for instance: Delaware shows a marked increase in everything except peaches, ranging from an increase of 40 per cent on cherry trees up to nearly 1400 per cent in prunes and plums. It is true that the plums and prunes in Delaware are still in limited quantity, although the increase was more than 7,000 bushels. During the same period, the increase in pears in that State was more than 130,000 bushels. Look at the comparative figures of the colder State of Connecticut. During the decade, the number of bearing apple trees increased nearly 50 per cent, cherry trees 60 per cent, peach trees 489 per cent, pear trees 43 per cent, plum and prune trees over 1200 per cent. Like in Delaware, some of these products are still in limited quantities, although the increase is marked.

Fruit-growing has been stimulated by the genius of the people in seeking new lines of profitable industry, but more particularly by the consumptive demand for fruit. The luxuries of a few years ago have become the necessaries of to-day. With a very large percentage of our population no breakfast, luncheon, or dinner table is complete without fruits in some form. There was a time when the delicious products of the tree and vine were sought by the rich to the remotest corners of the earth, even at great cost; but with the vast increase in production these fruits must seek markets, and not wait to be sought for. Notwithstanding the superiority of California fruits over most others on the globe, the vast increase in the industry in every direction causes the California grower to stop and inquire what of the future; where is he to find consumers, and how? The distribution of fruits is but another term for marketing, and I take it the committee so regarded it in assigning me the subject. Thousands of growers in California have found that they can overcome all difficulties, and grow the finest fruits the world has ever seen, but how to convert them into money at profitable figures is the ever present problem. From year to year they find they must have more consumers. These must be created. How to do this fast enough to keep pace with the increasing product is a question that will tax the skill of all the growers. That every pound of fruit grown in California could find a market profitable to the producer if properly brought to the attention of consumers there can be no doubt. I am not prepared to admit that we have reached the limit of profitable production, not to say anything about the so-called over-production. What we want is an orderly distribution of our fruit into the markets we have, and the education of consumers to require more of it. As I have said to this Convention before, people buy things because they see them, and because they are presented in an attractive form. After having spent a number of days at the recent Pan-American Exposition at Buffalo, I feel safe in saying that no exhibit drew more attention or created greater interest than that of California fruits, both fresh and cured. The beautiful display of dried and canned fruits was an unfailing attraction, and I have no doubt will bring thousands of new customers for these products. It will surely be so if like fruits are offered in the home markets where the people can see and buy them. Some method must be devised by which these cured fruits, prepared in the very best manner, can be put on exhibition, and sold in every city and village over the country. Thousands of people who seldom if ever buy California raisins, prunes, and other cured or fresh fruits, would become regular buyers and consumers of them if they were brought to their attention in attractive form, and at prices which would net the producers handsome profits. Furthermore, the people must be educated by making them acquainted with the delicious and health-giving qualities of these fruits. They must be brought to the notice of the house-wife, the steward, or the cook, as the case may be, day after day. As to the cured fruits, I would say that the plan of putting them up in small attractive packages ready for market is a most excellent one, provided the necessary machinery for distribution of them is put in motion. And every one of these small packages should be accompanied by some formulas for preparing for the table, or by some short crisp statement regarding the character of the fruit, its good qualities, etc. It may be necessary even to systematically carry these packages and sell them at the door-step.

It is perfectly evident that we can not depend upon a spontaneous demand; we must create one. Neither can we depend upon the usual channels of trade for the proper exploitation of the markets. Nobody except the man whose sweat and toil produced the fruit has enough vital interest in the product to push it constantly into consumption, unless he is paid for doing it. People in trade will devote their energies to the article that is easiest to sell, and the moment the demand for any particular article weakens, they turn their attention to something else, out of which a more ready profit can be obtained. There will follow a period in which the particular article neglected is not consumed in necessary quantities. We can not wait for people to buy our fruits as they buy flour, and meat, and shoes, simply of necessity. We must educate them to require our products all the time, because they have taste for them.

But you ask, how can all this be done? It involves vast detail and the expenditure of considerable money. It will surely be done, if it can be made to appear that it will pay; but the individual grower can not do it. He can not afford to do it on his own account, nor can he afford to employ agencies to carry his product and put it before the people in the way suggested. Paradoxical as it may seem, I will therefore say that the best way to distribute our fruits is to get them together. First, the interests of the many growers must be consolidated. If you have grown weary of the word coöperation, let us call it by that more modern term, "community interest."

It is true that the individual grower who packs his own product for market could place in every package some suitable advertising matter that would interest the consumer into whose hands it might fall, and probably have the effect to cause him to buy more of the same fruit, but even this form of advertising and of educating the buyers can be carried on much more systematically and successfully by the coöperation of the many. I have no doubt that the many thousand small packages of seeded raisins given away by the people of Fresno to visitors at the Pan-American Exposition will have the effect of making thousands of new customers for their seeded raisins. I do not pretend to be familiar with the method adopted for doing this work of distribution, but it probably fell so lightly upon the many parties at interest that no one felt the expense.

Last year the Southern California Fruit Exchange had printed half a million circulars setting forth the good qualities of the California lemon both for table and toilet; also, many formulas for the use of the lemon. These circulars were distributed by putting them into the boxes as they were packed for shipment. The cost of this to any one grower among the hundreds who bore the expense was so slight that it was a burden on no one.

These are but suggestions of the ways that could be employed for disseminating information and creating interest in the superior qualities of our fruits. Having aroused an interest, we must follow with supplies prime in quality and abundant in quantity. Not offering spasmodically; not waiting for the consumers to call on the retailers, and they in turn to go to their jobbers and demand these fruits; but we must see to it that they are always in their proper season in the hands of the jobbers, and if they are dilatory about it we must go past them to the retailers. If, however, there is a demand upon the part of consumers, jobbers will be very willing to handle them. It is difficult, if not impossible, to estimate the great damage and loss that will ensue if the interest in any of these fruits is permitted to lag during their proper season. People will not eat twice as many prunes in January because they did not eat any in December. In fact, if they are permitted to neglect prunes in December, and become accustomed to some substitute, it may take half or all of January to get them back to prunes. The work of advertising which I have suggested in the way of circulars, formulas, etc., must be supplemented by personal effort. I do not ignore, nor do I think I underestimate, the value of the ordinary channels of commerce through which any commodity is placed upon the market, but I am thoroughly convinced that these usual channels are not sufficient for our uses. As I have already stated, brokers, jobbers, retailers, and speculators, like the forces of nature, work along the lines of least resistance. In other words, they devote their attention to the thing easiest of accomplishment. Having no particular interest or investment in the production of fruit, they will deal with it precisely as with any other commodity. They will sell it when there is a demand for it, and neglect it as the demand weakens. As a consequence, any one or more of our fruits may at any time disappear from the markets for an indefinite period. Something else, or even nothing, may be substituted for it. This leads me to say that, in my judgment, if fruit-growing in California is to be permanently successful we must sell our products through agencies of our own. As President Bond, of the Cured Fruit Association, said in his annual report: "I would have the association sell its fruit through its own agents."

So thorough is my belief, gained by observation and experience, that this is of prime importance that I place it ahead of all other factors in the problem of distribution. If we want the work done we must go or send. Every other great business undertaking is exploited by personal and exclusive representation. Where is there another industry of so vast extent as fruit-growing in California that attempts to put its product on the market through agencies established for other purposes or with mixed interests? It has been stated upon the floor of this Convention that the fruit products of California have reached the enormous valuation of twenty-five millions of dollars in a single year. Will any grower attempt to maintain that this is not sufficient to justify the maintenance of the most thorough system of distribution? A very small percentage of this great sum would girdle the earth with the best talent obtainable and devoted solely to the introduction of California fruits.

This will separate the work of marketing from adverse influences; it will eliminate speculative features; it will establish permanent channels through which supplies reach the consumer; it will equalize distribution; it will reduce operating expenses; it will strengthen and steady prices. I have yet to hear what I deem a sound argument against this method. If you will excuse what may seem somewhat personal, I will say that the Southern California Fruit Exchange has its own offices in thirty of the principal cities of the United States. Salaried agents and assistants in these offices are constantly keeping our fruits before the attention of the jobbers in all of these cities and adjacent territory. In fact, by this method we cover every jobbing city in the United States and extend into Canada and Europe. Through these agencies, we are marketing half the citrus products of California satisfactorily to the growers, and to a large degree steadying the markets for the other half. These agencies are engaged exclusively and continuously in the sale of California fruits. They are not talking oranges to-day, bananas to-morrow, baking powder the next day, and so on, but are incessantly urging our own fruits upon the attention of the jobber and wholesaler, and if he should show indifference to them they go to the smaller and the country merchants with them. During the year since the last meeting of this Convention, we have sold through these agencies over 11,000 carloads of citrus fruits for nearly $9,000,000. In addition, we have sold for other coöperative organizations, some hundreds of carloads of California products. This we have done at a cost of but three per cent to the grower. We transacted this large business without the loss of a dollar from bad credits. Covering a period of five years and the sales of $22,000,000 worth of fruit, our total losses from bad credits have been less than one fortieth of one per cent. These facts and figures are cited to show you that the method I advocate is practicable, and can be carried into successful execution. It is not a dream. Pardon me for repeating what I have said frequently before in these conventions, that California fruit-growers ought, and as I believe must establish, control, and maintain their own agencies for the distribution of their products, kept free from the shifting influences of speculation. This must have for its sole purpose and object the interest and success of the individual grower. These agencies, dominated alone by and for the fruit-growers, must be the ever open doors through which the products of our orchards shall be borne in a steady but well-regulated stream into every market of the world. All of this can be done by a combination of all, with small cost to any. It can not be successfully accomplished without combination.

The address of Mr. Naftzger was received and placed on file.

OUTLOOK FOR THE PRUNE INDUSTRY.

By WILLIAM H. AIKEN, of Wrights.

From the standpoint of a prune-grower of twenty-five years' experience I can say that the outlook for the prune industry is good, with prospects of improvement. Let us first look back to the origin of the industry in Europe and trace its growth and development, so as to better understand its present importance and future prospects.

A thousand years ago, on their return from the Crusades, the Benedictine monks are said to have brought with them from Turkey or Persia what was then known as a date plum, and planted it in the garden of their abbey on the River Lot, in the vicinity of Bordeaux, France. Fortunately the soil and climate at that place were well adapted to the successful growth and fruitage of the tree, and fortunately, too, no other people of that time were as interested and skilled in the care and culture of fruits and flowers as the monks. From their abbey garden the trees were slowly transplanted to others, until in the course of centuries fruit gardens have dotted the hillsides and valleys of that part of France. True to its origin it has remained a garden tree, for there are, even to-day, no orchards in a commercial sense in Europe. The fruit became known in trade as Prune D'Ente, or Agen, the prune of commerce, and is the California French prune.

European Methods.—The European methods of growing, curing, and marketing prunes are much the same as they have been for centuries, and we think we have little of practical value to learn from them.

The trees are grown in France upon the plum root, in light, sandy, porous soils, rich in lime, but deficient in humus, and are trained high, with round tops, so as to let the sunshine in upon the ground to mature garden and field crops.

The prunes, when ripe, fall to the ground, and are picked up two or three times a week, and in wet weather every day. The fruit is placed on trays without dipping or grading, and baked in ovens with a temperature of about 158° F. When properly cured or baked, the prunes are offered in the market places and are bought by prune merchants, as usual, at their own prices.

The prunes are graded, processed, boxed, sacked, bottled, or cured, according to quality. The poorer grades are made into by-products, or distilled into brandy, without loss. This economy should be practiced by us.

In 1900 the French prune crop was about 100,000,000 pounds, and was sold at an average price of 4 cents per pound, all sizes, with little competition from California.

The German prune is raised in Germany for home consumption.

It seems that, commercially, the baked or cured prune is not held in as high esteem in Europe as formerly, the higher classes preferring preserved, canned, and bottled fruits and leaving the prune for the middle classes. This is said to be owing to the fact that the prune is not marketed, as a rule, in a neat, clean, attractive manner, except some of the fine, large grades that are sold, even here, at high prices. Much the same might be said of the prune business in this country. Some of our rich and well-to-do families live upon the ripe fruits and grapes of our orchards and vineyards in season, and out of season are supplied from refrigerators, and are not sufficiently attracted to our cured fruits to purchase very freely of them.

THE PACIFIC NORTHWEST.—We have an American competitor in the markets of this country, worthy of consideration in fixing prices on California prunes.

The States of Oregon, Washington, and Idaho have some 50,000 acres planted to prunes—2,500 acres to French, and the remainder mainly to Italian or Fellenberg.

The soil and climate of these States are not specially adapted to the successful culture and fruitage of either of these trees, and our enterprising neighbors are now seeking for a hardy and more prolific prune tree, the fruit of which will better stand their frost and rainfall.

CALIFORNIA.—The outlook for all Pacific Coast industries is good, with prospect of future development and profit.

The American invasion of the Pacific islands and countries will establish a peaceful commercial supremacy and make profitable markets for our surplus fruit and other food products.

The United States canal will enable us to compete in the markets of Europe and carry the prune war even into France.

In times of peace and practical exclusion from the markets of the world, the California prune-growers have planted, watered, and cultivated, and have in hand to-day one of the greatest, and probably the most profitable, of the industries of the State, and one that is capable of extension and improvement according to the demand for prunes in the markets of the world.

It is not advisable, however, to increase the prune acreage of the State very much until all these things come to pass.

The prune industry of California is only, commercially, thirty years old, and has experienced the fate of other industries in its rewards and losses.

Comparing former with present prices, some may conclude that prune-growing in California does not pay as well as it did in early years, and complain that they can not get more than one half the prices they formerly did. We must not fail to take into consideration the important fact that the purchasing power of the money we now receive has doubled in the past thirty years. For instance, we now pay for clothes, shoes, sugar, kerosene, tinware, hardware, and furniture for our homes and steel products for the farms, substantially only one half what we paid when we started in business some thirty years ago. The wages of labor, however, have kept up to a high standard, making our enterprise profitable at least to the hired man who has proved himself worthy of his hire.

THE CHEMICAL COMPOSITION OF PRUNES.—The Agricultural Department at Washington, D. C., has analyzed prunes grown in France and Oregon, and the State University has analyzed the prune grown in California, so that I am able to submit to you a comparative scientific test of sugar and fruity quality in the prunes of those countries:

Variety.	Number per Pound.	Percentage.			
		Flesh.	Pits.	Acid.	Sugar.
French (Imported)	50	87.8	12.2	.56	41.56
French (Oregon)	128	78	22	1.51	35.15
French (California)	45	88	12	----	55
Italian (Oregon)	38	87.6	12.4	1.51	35.18

The California prune, though raised by me in the Santa Cruz Mountains, in Santa Cruz County, may be considered a Santa Clara prune in quality, as the trade pays the same for it. The record shows that the California prune is superior to any other in sugar, which is the standard of excellence, indicating rich, fruity quality, and, further, that the French and Italian prunes grown in Oregon have the same acid and sugar.

Californians, don't get discouraged, but, believing that you can produce the best prune on earth, do it bravely and well.

Raise and sell sound, ripe, well-cured prunes that will command full value, and that can be sold by the merchant at a profit and eaten by the consumer with a relish.

Stand up for your State, county, home, and business, and make your product a luxury and a necessary of life, thus becoming benefactors of yourselves and mankind.

The address of Mr. Aiken was received and placed on file.

DISTRIBUTION OF CALIFORNIA CANNED AND DRIED FRUITS.

By ISIDOR JACOBS, of San Francisco,
Of the California Canneries Company.

The proper distribution of California canned and dried fruits in the various markets of the world depends very largely on demand, methods, men, tariffs, quality, and transportation. All of these are the result of concentration of thought and effort, and are dependent on the man or men employed. Much, too, depends upon the opening up of new markets and new customers for our products, keeping those markets we already have, and increasing the trade wherever possible.

The distribution of goods must be confided to men who can concentrate their thoughts on the proper disposal of goods for the best interests of the manufacture in canned fruits, and the best interests of the producer in the sale of dried fruits, including raisins. The avenue chosen for the disposal of California canned and dried fruits should be entirely free from speculation of any kind or nature. A commission dealer interested in the articles he handles, or similar articles, excepting so far as relates to his commission, can not do justice to his principal, no matter how good his intentions might be. The men chosen to handle this most important part of the work must be free from any entanglements that will prevent their doing their very best for their principals.

Manipulation in these lines, by parties who are expected to look after the distribution of the products, is largely responsible for the conditions existing, and until both canned fruits and dried fruits are handled in the most direct way, the business will never be the success that it should be, or on a firm and solid footing. In canned fruits, with ample capital, any amount of these goods can be manufactured, and they should be packed with the greatest possible care as to quality and grading; but the most important thing is to dispose of them at a profit to the manufacturer, and in a way to accomplish the best results with a view toward increasing the trade. This requires effort and concentrated thought, and the failure to dispose of the goods promptly and on a profitable basis causes the lack of success.

Quality and grading aid materially in the disposal of these goods, but unless the quality is maintained, the trade will drift away very quickly. To make a complete success of the fruit-canning trade, the goods should be disposed of by men who can devote their thoughts to the disposal of the goods on the most direct basis, and, at the same time maintain, undisturbed, amicable relations between the principals and their customers. In order to succeed in this, good faith must be exercised on both sides, and it is injudicious and injurious to the future of the trade if quality is not maintained, or the markets are overloaded to the detriment of the trade, resulting in dissatisfaction to buyers, and thus injuring future prospects of the seller.

In dried fruits—particularly raisins and prunes—the same rule will apply. The difficulty in these lines seems to be almost entirely in the methods of the disposal of the crops. The crops are ample, but they are not distributed and sold as fast as they should be. The cause of the difficulty is in the distribution and sale. The opening up of new markets, and the securing of new customers, do not keep pace with the increasing production. The difficulty is not over-production, but rather under-consumption. Many of the producers, instead of standing together, are allowing themselves to continually come under influences that are diametrically opposed to their best interests. If they could only look at this matter from the standpoint of what is best for all concerned, their efforts would result in success.

Present conditions in the disposal of these products have been brought about by the fear of active competition of commission merchants (so called), who are not only commission merchants, but also brokers, dealers, speculators, and, in many instances, packers.

One of the causes of lack of success is handling goods through agents who are interested in other lines of products, for they are bound to devote their attention to those goods which are easiest disposed of, and on which, therefore, they can easiest earn their brokerage and commission, to the consequent neglect of other lines which require determination and push to dispose of them. Systematic methods of advertising and permanent exhibits will also have to be adopted, for the products must be brought in a more direct way to the attention of the consumers. The opening up of new markets in foreign lands is, of necessity, slow growth, and must be undertaken in a very careful way. The foreign trade is not worth cultivating unless it is to be a permanent one; therefore, the man or the concern desiring to go into this market should see to it that when once in the field he has a sure prospect of remaining there. The main consideration is to supply a standard quality of goods. Strict honesty is absolutely essential. Everything sold must be as represented. To send high-grade goods at the beginning and then to let the quality drop is worse than folly. It is a good form of business suicide. The foreign buyer is generally a shrewd judge of values, and it is impossible to deceive him more than once. It is highly essential that the manufacturer and producer should not remain content with merely filling the orders that come in, but he should cultivate and enlarge the opportunities that are now his. When he is fairly established he may be reasonably sure of holding his trade, for the foreign customer is conservative, and strong inducements must be offered him to cause a change when once he has formed a habit of buying certain grades and qualities.

One of the causes that is preventing the increase in the distribution of California canned fruits is the fact that a considerable percentage of inferior grades is turned out bearing attractive labels with the word "California" on them. Consumers purchase these goods as California canned fruits, and finding them of poor quality, and not knowing that the goods they used were below the average quality of California canned fruits, they stop using them, thus injuring the industry very materially. The remedy for this is to have fewer grades, and have the cans of seconds and inferior grades plainly stamped with *the* quality contained. It seems ridiculous and inconsistent for California canners to jealously guard the name "California," and to protect its use by enjoining Eastern packers from putting goods on the market bearing the name "California," while, at the same time, they are turning out goods, grading them as seconds and water, on which attractive labels are placed with the word "California" prominently displayed, but with no indication on the label of any inferiority of the goods contained therein. The strange thing about this is that on these inferior grades there is no margin of profit for the canner. These methods have already interfered with the natural increase in trade in these goods, and unless some steps are taken to remedy the evils resultant from these methods, no considerable future increase in the distribution need be anticipated.

The tariff is a subject that is allied very closely to the distribution of California canned and dried fruits, and in this regard there is a great variety of opinion—also a diversity of opinion. The distribution of California canned fruits in foreign countries would be materially increased if the tariff into those countries could be reasonably reduced. In Germany, France, and nearly all European countries, excepting England, the tariff is very high—in Germany, amounting to nearly 30 cents per can, which is more than the selling price of the goods—being almost prohibitory. The reduction in the tariff on dried fruits into Germany resulted in an enormous increase in the trade in California dried fruits. What was done with dried fruits could be done with canned fruits.

Even though we do not favor reciprocity treaties, why should we be so blind to our own interests as not to make united efforts to obtain some concessions in our favor, if it is to be the policy of the administration to adopt these treaties. We do not know that in these reciprocity treaties the interests of great corporations are sufficiently strong to obtain favorable results. California is, in these negotiations, considered only as a very small part of the country.

A committee of the Home Market Club of Boston recently reported as follows: "Among the most gratifying conditions of the times, which are attended with so much prosperity at home, is the fact that we have already extended our trade abroad and have secured so large a place in the markets of the world. The time is auspicious for continuing and completing the conquest. It must go on without delay and must be thorough and permanent. To that end every step must be wise, successful, unretreating, and must command and retain the confidence and approbation of the American people. We must injure no existing American industry. We respectfully request Congress, therefore, to collect without delay, from every available source, full and exact information as to the effect of all proposed treaties upon industries now successfully established, so that none may be sacrified, and in that way whatever may be accomplished shall be both beneficial and enduring."

For some years past it has been urged and advocated that a permanent California Bureau at Washington, D. C., be established, so that a direct representative of this State would be in continual touch with the different National departments, particularly during the interim between one session of Congress and the other. Such a representative could not only insist that the interests of California should be protected in these reciprocity treaties, by asking for lower rates on such of our products and manufactures as could be benefited by them, but at the same time protect California's interests by seeing that the tariff into this country is not reduced on such articles on which low tariffs would tend to injure the sale thereof. Such a representative would gather valuable statistics and be prepared at all times with the necessary arguments to show our requirements on both sides of the question.

At a recent meeting of the Chamber of Commerce, in this city, Mr. Wm. M. Bunker was chosen as special representative to permanently represent the interests of the chamber at Washington. No doubt he will look after reciprocity matters, questions of tariffs, interstate commerce, and other subjects of legislation, so far as they affect the interests of this State.

Not the least feature in the distribution of California canned and dried fruits is transportation facilities, and the future holds out brilliant promise in this regard. New lines of steamships, the promise of the Nicaragua Canal, and new lines of railroads, mean new territory to be opened up. At the present time it is hard to say what effect the amalgamation of the different lines of railroads may have on the future of this State's products. Certainly such amalgamation ought to result in better facilities for moving the products to their markets, and it would almost seem that unity of interest should result in the manufacturer and producer seeking new markets, and the transportation companies opening up new and vast sections to the traders of this Coast.

In this regard, the interests of shippers and transportation companies are identical. The transportation companies should name such rates as will result in opening up new markets for our packers and producers and enable them to hold those markets that they already have. They must also recognize the necessity for more rapid transit of the products to market, and in every way possible improve general transportation facilities.

A factor that may be relied upon to help enlarge our trade abroad is the tendency that is showing itself in the way of restoring our supremacy as a nation of shipowners. It is undoubtedly true that trade follows the flag. Even though it be shown that the establishment of foreign trade does not depend necessarily upon the carrying of goods in our own vessels, still it is undoubtedly true that the flag helps materially.

New transportation facilities to Vladivostok and the vast Asiatic Siberian country will afford us in the near future great possibilities in the way of distribution of our products.

Methods in the successful distribution of California canned and dried fruits depend largely on the men who direct them. Only men of the widest experience and energetic force should be chosen, and at the head of each enterprise should be one man who can sit quietly in his office and devise the proper methods and see that they are properly carried out by those chosen to do the work. He must not be under the influence of excitement or other disadvantageous circumstances, but be able to consider carefully the methods necessary to make a complete success of the enterprise.

Dr. Thwing, President of the Western Reserve College of Ohio, in a lecture delivered in this city some months ago, said that Mr. Rockefeller told him that one of his greatest difficulties was to find men to whom he could pay $25,000 per year salary to do some of his thinking for him.

Men are required who can accomplish something—men of force, men with concentrated energy, men who have a definite purpose and who know how to execute it with their entire strength. The need is for men who can produce results—men possessing tact, practical ability, and executive force.

The men who would keep abreast of the ever increasing tide of progress in trade must not rest satisfied with the business methods that brought success years ago. They must keep their business up to the standard by the constant infusion of new ideas and improved methods. No man can afford to rest content with bringing his business up to a certain point—he must ever be reaching out beyond that point.

In reference to the causes that prevent the natural increase in consumption and distribution of California canned fruits, it appears that the responsibility rests on the fruit-canners themselves by the pursuing of a shortsighted policy, which is resulting in holding the business in check and retarding an industry which should progress and increase throughout the world. Strict honesty to the consumer alone can accomplish this object. Either inferior grades should not be put out at all under a label bearing the word "California," or the label should state exactly the quality of the goods, so that the purchasers may know what they are buying and the consumers what they are getting. California canned fruits in former years acquired their great reputation throughout the world entirely because the quality turned out under the name "California" was superior and in heavy syrup. This has been changed by the methods adopted in late years, and to-day considerable goods are turned out under the name "California" that will rank inferior to many Eastern packs—a practice that is destroying, with many consumers, the prestige and popularity that California canned fruits formerly enjoyed in the world's various markets.

In raisins and dried fruits, the distribution must be carried on in the most direct way and without fear of antagonizing any of the elements that stand in the way of progress and increase of trade. The prune and raisin men must not be discouraged at their present seeming failures to make a success of their associations. If we examine the paths of almost any business success, we will find it paved with failures; in fact, in many cases, failures have been the guides that pointed the way to success. The lessons they taught, the suggestions they gave, showed the way to win. As the poet Moore has well said:

"'Tis the coward who stops at misfortune—
'Tis the knave who changes each day—
'Tis the fool who wins half the battle,
Then throws all his chances away.

There's little in life but labor,
And to-morrow may prove but a dream—
Success is the bride of Endeavor,
And luck but a meteor's gleam."

The address of Mr. Jacobs was received and placed on file.

DISCUSSION ON FRUIT DISTRIBUTION.

MR. NAFTZGER. The questions that have been presented to this Convention are now, I believe, open for discussion. I feel like saying "Thank you" to Mr. Jacobs for saying what I did not venture to say. I thought while he was reading his paper that it might be suspected that there was more or less of a conspiracy between him and me upon this subject of agencies, but I assure you that I have not seen Mr. Jacobs since I heard him read a paper in this Convention at its last meeting; so there is no conspiracy, only he is right and I followed in his light. I say that I thank him for saying a little more on the same lines than I had ventured to say myself. At several sessions of this Convention I raised more or less discussion and I think was misunderstood; I got some very severe criticisms—not, perhaps, from any of the fruit-growers, but I got it from some of the newspapers with whom we do not advertise. I have no disposition now to say "I told you so." I cheerfully emphasize and indorse everything that Mr. Jacobs said, which was decidedly on the same lines, more pointedly though, with the matter contained in my paper. When he says that the fruit-growers of California can not depend upon the packers and speculators to market their products, he tells the truth. That is the root of the difficulty which confronts certain fruit-growers of California to-day.

A MEMBER. You might have added the packers.

MR. NAFTZGER. Well, they are speculators. A prune-grower said to me on this floor to-day that fully one half or more of all the prune-growers of the Santa Clara Valley are tied up with crop mortgages of the speculator. I have no doubt it is true, because Judge Aiken told me so. He said it was for this reason that the growers did not get anything out of their crops, and were obliged to have money. Now, where did the other fellows get the money? Did you ever think of that? Did you ever stop to inquire where the packer and the speculator got the money to lend? They got it out of the grower; the wrong man has the money; that is the trouble. The man who has expended his energy, has grown up with the trees, and grown gray under the trees—the man who has spent his toil, and energy, and life trying to make a crop, is not the man who has the money, but he is the man who has got the mortgage on his farm.

One of the directors of the Cured Fruit Association told me that there was an increase of eighteen per cent in sizing and the dipping of the prunes. I don't know whether that is correct, but one of the directors of the Cured Fruit Association told me so. He said there was eighteen per cent gained in sizing and dipping, and I understand there is also eight to ten per cent difference in the selling. Thus, I say, I emphasize what Mr. Jacobs said on that point. I don't say a word in disparagement of these people. I have declared on this floor repeatedly in Conventions past that we have no imputations of dishonor for the packer or the speculator. He is here because the grower gave him a reason to be here, and he will always be present when there is something to be speculated upon. I am telling the fruit-grower, and what I mean to emphasize to the grower is, that until you learn to do your own business you may expect to have the mortgages on your property.

Mr. Jacobs said, and truthfully too, that the avenues and channels of distribution are inadequate, and that we need more consumers, and that we are not properly reaching the markets through these shifting ways that are alive to our interests to-day and to some other interests to-morrow. I say again, what I have repeatedly said before, that when this vast interest of fruit in California, one of the largest interests of the State—one of the very largest of all the products of California, as Mr. Berwick stated this morning, running to probably $25,000,000 annually—when this vast product gets ready to do business on its own account it will do business profitably to its growers and to its owners. But fruit-growers are afraid of expense. They don't seem to think that they are paying the expenses, a small portion of which would insure better methods; but they are enriching and preparing the other fellow to get a mortgage on their property. Now, there *is* some expense attached to this work; but look at the product upon which you have to exploit the markets and establish your agencies. I stated to you in my address that what I have done down South in a small way is but a beginning of what California growers can do when they take hold all together. As Mr. Thomas said, "When you make the umbrella big enough for us all."

In our association to-day we have a payroll of $7,000 a month; yes, it will take more than that—probably $300 a day for the working days—to pay our employés. Why, we have a telegraph bill of $100 a day, and it takes a carload of fruit every day to pay our expenses, but we are selling hundreds of other cars, and at the same time after all is said and done we do our business on less than one half the expense that has ever been attached to any fruit-marketing that I am aware of.

This is only the beginning of what can be done by the California fruit-growers when they all coöperate and do business in the proper way.

MR. BERWICK. After the Convention closed this morning I was called to order by a statistician. He said the figures quoted by you are entirely to small, and makes the *increase* $35,000,000 over the period of ten years since. It was an increase of $35,000,000 annually since 1890. I judge we are not all fruit-growers here; sometimes we have commission men with us when we are talking about the marketing of fruits; but I wish to say that a serious thing happened to the fruit-grower this year. We have been paying constantly in San Francisco eight per cent commission on goods sold for us here. That is what you all had to pay in the past; this year it was arbitrarily raised to ten per cent commission on goods sold in San Francisco. I wrote to my commission man for the reason of this increase, and the reply was, "It is common all over the Union; the ordinary charge is ten per cent, and this thing has been coming for some time now." That is the only reason I got. If there is a commission man here I would like to know why you have been forfeiting two per cent of what was your money before. If you sell a box of oranges for $2 they charge you a commission not only on your freight and cost of packing, your boxes and paper and those things, but also on their own commission. They charge you the full ten per cent on the gross, and your box of oranges pays twenty per cent commission. They have charged you two cents to pay a commission on their own commission. Do you see the point? You pay commission on the whole thing, including the commission man's commission. That strikes me as rather hard on the grower.

MR. AIKEN. Some time ago we established in the East an agency for green fruit. The commission was eight per cent, and we made them return one per cent of it, which they did, and that proved that they could do it for seven if they wanted to. We made them the offer that we would give them the business for seven per cent and give the growers the one per cent.

Now, as to the Eastern grape-shipping business, I think it is seven per cent we pay, and the business this year has been very profitable, I think, to shippers generally, varying of course with small crops. I had occasion to visit the Eastern states and cities this year, looking a little after the fruit industry and the selling of grapes, and I found the business well done there. The object was to display California fruit in the auction-rooms so that the bidders could examine the quality and come to a fair judgment of what it was worth; and it was observable in attending the auction-rooms that where there was real merit in the product there was some competition among the buyers and the price would move up. But maybe a large quantity of those shipments would be a little off in quality, and such shipments would be kind of divided among them; but there was no spirited bidding outside of the articles that showed real merit on the face of them. I want to say to people who ship plums and grapes that they should pack them with honesty and integrity. Try and have every box perfect—not only for this year alone, but for all the years you are in the business.

I have observed that the brand honestly established in the Eastern market will sell any quantity of fruit at a paying price; so it comes back with force upon the grower to be very honest and careful in the selection, packing, and preparation of his fruit for the market. I say, from my observations in the East, that an article showing real merit upon its face does not go begging for purchasers, but brings good returns that pay all charges and expenses, and returns double what is received in San Francisco. I have a very large line of shipments of table grapes. I have realized, after paying every commission, over $100 per ton, but it is because I have established my brand for that kind of fruit. Those who have shipped to the San Francisco markets have said that they only received twenty-five per cent of that amount, and have paid ten per cent commission out of that.

MR. SPRAGUE. Now as to the condition of the San Francisco and Coast markets—they must be treated as one market. Of course those men who sell your goods will get all they can; we may expect them to do that; and it should be our business to see that we so organize our work that they can not get more than is fair for them to get. All we ask is for these Sacramento Valley growers to get together with us in the South, and then we ought to do something.

MR. MOTHERAL. I think the Raisin-Growers' Association of Fresno and Kings counties and of the State of California is in a better condition to-day than it ever has been. I believe we are in a position to control, and will commence next year by controlling three fourths of the raisins of the State. We are all beginning to be convinced of what you have heard here before—that coöperation is the only way. We have got to do business from start to finish; we can not afford to have a lot of fellows on the outside doing part of our business and we doing the other part. We have got to have an agency by which we ourselves can sell our fruits in the markets of the world; we will have to pack and sell our own goods. I think that will be done next year, and I believe this: that when we accomplish that we will not have any more trouble.

MR. JACOBS. I feel as if I would like to return the compliment to Mr. Naftzger. The most important problem confronting the fruit-growers of California to-day is the coöperation of the producers. I feel almost as if I had already seen what I wrote in my paper, for Mr. Naftzger and I both touched upon the same subject in the same way. But as he said, I have not had the pleasure of seeing him since a year ago at the Convention here. I believe one of our greatest difficulties, and one that is the foundation of all our troubles, is the question of fear that has been in the minds of our growers in this part of the State. They have started in from the wrong standpoint, because they fear active competition from people who have interests opposed to theirs.

In speaking of commission merchants and speculators, which, of course, includes packers, it does not necessarily follow that we have anything against them except as to the methods adopted and the results to the producer. Having grown up in connection with the fruit interests of this State, I believe and know, as we all do, that the future prosperity of California depends upon the prosperity of the producer.

The strange thing to me is that the people interested in growing prunes and raisins, and the manufacturing and packing of dried fruits, have not seen that when an association, such as Mr. Naftzger is at the head of, has made such a success in the disposition of the orange, which is a perishable product, how much more possible it would be to make a success with raisins, prunes, and other dried fruits. But they have gone on from year to year, the conventions meet and the same subjects come up in different forms, and there always seems to be the fear that if they antagonize the elements that have been distributing these goods they are going to be hurt, and they sit down and permit the same state of affairs to go on.

We are not over-producing, but we are not taking the right methods of disposing of our products; we are not getting the right men at the head of our organizations. Much of the success of California depends upon the men who will make a success of these organizations.

MR. BERWICK. I move that this Convention protests against the arbitrary advance of two per cent commission by the commission men of San Francisco on the sale of California fruits.

MR. SPRAGUE. I move to amend by suggesting that a committee of three be appointed to investigate the matter and report to this Convention.

Motion carried.

President COOPER appointed the following committee: A. R. Sprague, F. M. Righter, and Chauncey Gaines.

PROF. CHILDS. Mr. President, I wish to make a few remarks on one of the paragraphs in Mr. Aiken's speech in regard to the prune industry of the Santa Clara Valley. During the past four or five years we have had several dry seasons, and even last year, with a very large crop, Santa Clara did not produce one half of the entire prune crop. It is very likely that we will now have some wet and warm seasons, and the valley will produce more prunes than we will be able to market in one year. Our people are studying the conditions, and many of them are doing what we had better do all over the State. A great deal of the fertility of the soil is used in producing limbs and pits. Many of our best orchardists are taking out every other tree, and last year I know of one orchardist who had three times the number of prunes to the acre than when all the trees had stood, and much better prunes at that, and it costs less to take care of an orchard with one half the number of trees. I believe that the best thing that could happen in the prune industry would be to take out one half of the prune trees in this manner.

MR. AIKEN. By coöperation, my friend Naftzger has made a great success of things in Southern California. In San José it is said we failed in the Cured Fruit Association; but we didn't; there is a little misunderstanding about that association. The association never intended to sell fruit; it was not organized for that purpose; it was evidently organized to give the fruit crop to the packer for sale, and let him take the money for it. So far, the fruit has been sold; but one misfortune was that the packers who received their allotments owned too many cars in the East for them to sell them in the time they agreed to, and they have been thrown back upon the association. The association has been trying, in the markets of the world in the past year, to sell those prunes and distribute the money among the growers, and it is trying to do so now.

MR. JACOBS. Mr. Aiken said that the trouble was the packer has been compelled to throw back his cars upon the producer because he could not sell them, and the reason the packers could not sell the amounts allotted them was because the grower was depending on the packer, and the packer depending on the agents, and the agents on the packer, and by the time the wholesaler got the crop there were so many commissions that he could not devote his time to it on account of the commissions having been cut up so much that there was not enough in it for him to devote his time to it. The whole thing lies in the method of distributing the fruit, and until that matter is settled the fruit-grower will be the sufferer.

MR. RIGHTER. Some years ago a man came from this city to San José who said he would teach us something. I asked him if it would make any difference in the number of cars of fruit you sell, whether you give these growers $20 or $30? And he said, "Not a bit of difference." He said, "If you fellows stand together you can get $30 as well as $20." The expense of selling our fruit through the commission men as we now do costs us $10 where it costs the Southern California Fruit Exchange $1 for the same service. You must have good men at the head of the business in disposing of your products, and if you believe you can get along with a cheap man you are going to fail. Mr. Carnegie said, "It pays you to hire a man who can earn for you one million dollars at a salary of half a million," and it will pay the fruit-grower to hire men of ability to conduct the selling of their fruits. And I believe it is your selfishness that prevents you from taking hold of your own business.

PRESIDENT COOPER. Reports of committees are now in order.

REPORT OF COMMITTEE ON FRUIT PACKAGES.

The Committee on Fruit Packages submitted the following report:

To the Chairman and Members of the State Fruit-Growers' Convention:

Your Committee on Fruit Packages, appointed at the last annual Fruit-Growers' Convention, respectfully submits the following report:

Your committee will confine its remarks to packages for cured fruits for domestic and foreign shipment.

It is very generally conceded that the 25- and 50-pound boxes meet the approval of about nine tenths of all the packers and buyers of cured fruits; hence, we recommend the adoption of a standard package of the following dimensions for the packing of cured fruits when ready for shipment:

The inside measurements of a standard 25-pound box should be 5¾ x 9 x 15⅛ inches. The top, bottom, and sides should be made of $\frac{5}{16}$ stuff for domestic use and not less than ⅜ stuff for export.

The inside measurements of a 50-pound box should be 9⅜ x 10⅞ x 15⅛ inches. The top, bottom, and sides should be not less than ⅜ of an inch thick, but consider ½ inch stuff preferable.

Packages for export trade should be made of heavier material than those for domestic use, and the 50-pound package should be proportionately stronger than the 25-pound package.

The wishes of the foreign buyer should be studied, and to that end use a 12½ kilo (27½ lbs.) instead of a 25-pound box, and a 27½ kilo (55 lbs.) instead of a 50-pound box, for French and German shipments of California cured fruits, other than evaporated apples. These have been packed for years in 50-pound boxes throughout the Eastern States, from which point Europe has heretofore drawn her supplies, hence, this style of package is used here.

The committee would recommend for general use the nailed box in preference to the dovetailed box, the nailed box being less expensive, and when properly nailed makes a stronger package and can be shipped from the box factory to the packing-house in shook, which is the most convenient and economical form of shipping box material.

The 80-pound box now in use by some packers should be discarded from the list of standard packages. Complaints from receivers of California cured fruits in foreign countries regarding broken packages and loss of fruit, generally arise from insufficient nailing and careless packing in boxes made of light material.

If the sides of the box are of sufficient thickness to permit the nailing of the top and bottom to the sides along the edges and the box packed solid with fruit, you will have a package sufficiently strong to withstand the average hardships of transportation, and one that will overcome the complaint of foreign receivers regarding broken packages. The manner of pressing the fruit into the box is largely responsible for broken packages, particularly the 50-pound package.

Packers of cured fruits, prunes, etc., for shipment to foreign countries should exercise special care and not subject the fruit to too great a pressure, crushing the fruit into the box in such a manner as to prevent it from springing back and completely filling the box after the cover has been nailed on.

Packages with a vacant space between the fruit and the cover are easily crushed by the rope sling used in loading and unloading steamers and other vessels or when stepped on by careless people. To overcome the danger of broken and crushed packages, packers should use "followers" in their presses of a thickness that when the press is down the bottom of the "follower" will be on an exact level with the top of the box. Naturally when the pressure is removed the fruit will swell and spring back a little against the cover, and this will fill the box solid with fruit.

Quotations on cured fruits to foreign buyers are made c. i. f.; or, in other words, the price named covers cost, freight, and insurance. Competition between local packers is keen, and foreign buyers hesitate to pay anything extra for a strong package or extra freight on the same; hence, the difficulty in adopting a standard package for export trade, one having sufficient strength to withstand all the phases of transportation to foreign countries.

Your committee is of the opinion that a standard package for cured fruits would certainly prove not only desirable, but also profitable to growers, packers, and shippers, and particularly would this be the case with the box manufacturers. Packers readily understand why it is that the box factories are unable to make prompt shipment of shooks during the busy season. Packers, as a rule, anticipate their wants in the way of box material and order in advance, but are not always far-seeing enough to be prepared to meet the rush of orders during the busy season and must rely on the box factories filling their orders with as little delay as possible. With boxes, as with labels, the orders must be filled in their turn, and frequently the delays are not only very annoying, but also costly.

Box factories are unable to cut and accumulate box material during the dull season, owing to the fact that nearly every packer uses a different size or style of package. The multiplicity of styles and sizes results in a great deal of confusion, although all aim at the same result—a package to hold 25 or 50 pounds of cured fruit; hence, your committee can see no reason why an effort should not be made to adopt a standard package of uniform size.

The dimensions of the material used in manufacturing a standard 25-pound package are as follows: 2 ends, ⅝ x 5¾ x 9 inches; 2 sides, 5/16 x 5¾ x 16⅜ inches; top and bottom, 5/16 x 9⅝ x 16⅜ inches. These measurements apply to package for domestic use. Same measurements for the 25-pound export package, except that the sides should be of ⅜-inch stuff. Material cut as above will make a package measuring on the inside 5¾ x 9 x 15⅛ inches.

The 50-pound package for domestic use measures on the inside 9¾ x 10⅞ x 15⅛ inches; ends should be ⅝ x 9¾ x 10⅞ inches; sides, ⅜ x 9¾ x 16⅜ inches; top and bottom, 5/16 x 11½ x 16⅜ inches.

The 50-pound domestic and export prune package should measure inside 9¾ x 9¾ x 15⅛ inches; ends, ⅝ x 9¾ x 9¾ inches; sides, ⅜ x 9¾ x 16⅜ inches; top and bottom, 5/16 x 10½ x 16⅜ inches. This package would be stronger and more desirable if ⅜-inch stuff was used for making top and bottom.

Your committee is of the opinion that California cured fruits, properly packed in 25- and 50-pound boxes, will in the long run give better satisfaction to all parties interested.

We will here mention the fact that very many Chicago buyers, as well as buyers west of that market, desire cured fruits packed in sacks. This, in our opinion, is not the most desirable way in which to pack and ship California cured fruit.

The attention of the members of the Convention is called to the following comments of Professor Edward R. Lake in his article on "Prunes in Western Europe," which, in our judgment, thoroughly covers the matter of careless packing and the use of poor, rough, odd size packages. Professor Lake says:

"The most neglected phase of the prune industry is that of packing and packages. In the marketing of no other fruit or food product, save possibly the coarser vegetables, is so little attention paid to attractive packing and packages. Not less than four fifths of the product is put upon the market in large, rough boxes or bags, and especially is this the case with the smaller sizes of the European prunes and those from the Pacific Northwest. A few of the larger packing establishments of France, Germany, and California use a moderate amount of taste and a fair quality of material in their packages, while one or two French and German firms put upon the market a limited amount of very fancy packages of choice fruit.

"On the markets of eastern United States and Europe prunes are usually handled like peanuts and potatoes. Instead of being handled as a prepared fruit food, they are treated as a raw article; exposed to the flying dust and dirt of the market place; shoveled and carted about just as one might handle coal, in old boxes, barrels, sacks, or trays. The result is that as the housewife passes from place to place making her purchases for the table the thought of dried prunes for sauce gives her a feeling of mild disgust, and justly so. If the average curer of prunes on the Pacific Coast could see the article as it is commonly marketed in the large cities, he would feel distrustful of his own senses.

"Not all of the evaporated fruit is thus handled, but a large amount reaches the consumer in this way. Not alone the smaller grades, though certainly a larger per cent of these are thus sold than of the fancy grades, but some of the fruit of 40–50 grade is sold with so much dirt upon it that the work of preparing it for the table must be as great as for potatoes. This condition can only be overcome by adopting a style of package that will not permit handlers and dealers to foul the fruit.

"There appears to be no reason why this product under ordinary conditions, providing it is protected from attack by insects, will not keep for two or three years without serious deterioration. Certainly there is no reason why it should not be placed on the market in such manner as to make it as attractive as the canned product, which is the chief competing article. While it is possible that much of the evaporated product is of too low a grade and quality to warrant even a small additional expense for fancy packing, yet for all the higher grades and best qualities it would appear that this is a field worthy of thorough investigation by the progressive packer and shipper. In the world's markets of to-day attractive packages count for at least as much as quality with the majority of buyers, and since dried prunes are looked upon by many as a coarse food, it is the more important that careful attention be given to their market appearance. The glass jars, bottles, and cans in which some of the Bordeaux packers put up a portion of their fancy quality prunes are too expensive for the general market, and yet, thus far, these are the only packages in which the fruit keeps for an indefinite period without decreasing in value through being worm-eaten and sugared. The great need at present is a cheap, light, fly- and air-proof package."

B. N. ROWLEY,
A. J. HECHTMAN,
A. G. FREEMAN,
R. W. HERSEY,
W. M. GRIFFIN,
Committee on Fruit Packages.

Upon motion, the report was adopted.

The Convention then adjourned until 9:30 o'clock Wednesday morning.

PROCEEDINGS OF SECOND DAY.

WEDNESDAY, December 4, 1901.

President COOPER announced that the matter of the consular service was laid over yesterday for the purpose of hearing Mr. Goodwin this morning, but Mr. Goodwin not being present, the following business was proceeded with:

MR. RIGHTER. I have in mind that the President of the United States has written a message to Congress, in which he has recommended a great many things for this Coast, in all of which we are deeply interested, and now I move that the President of this Convention appoint a committee to draught suitable resolutions to that effect.

PRESIDENT COOPER. I would say, in that regard, that the province of this Convention is only to discuss and take up questions which concern the fruit industry of the State of California, and that the best plan—in fact, the only plan—of properly bringing that question before the fruit-growers would be to appoint a committee to take that matter in charge and to bring a resolution before this Convention touching upon only those subjects in the message which concern the fruit-growers. There are only two or three of those questions. One is irrigation and forestry, and another is the oceanic canal. There may be others also.

MR. RIGHTER. Consular service also.

PRESIDENT COOPER. Yes, those are three things that may come before this Convention. You should separate those things, and make it understood that this Convention meets only for the purpose of advancing the interests of the fruit-growers.

MR. MOTHERAL. I move that a committee be appointed to report to this Convention covering those matters.

Motion carried.

DISCUSSION ON CONSULAR SERVICE.

MR. ADAMS. There are certain things that can be had from consular service. I know a great many people who are extensively engaged in fruit-growing, yet with that knowledge were I to undertake to get down and telegraph the exact condition of the prune or raisin market here, the chances are sixteen to one that I would not get it right. No one can get down to the business of the thing without knowledge. Those minute details you can not get out of any consular service. But those items which appear in the current literature of the country to which he is assigned he can get, and this information is the greatest possible information to the fruit-growers. But the details you can not get outside of those actually engaged in the business.

It demanded a great deal of work when we went into that correspondence. We had the labor, in the first place, of inducing the State Department to take hold of the matter. Congress would make no appropriation without the recommendation of the Secretary of State. We entered upon a correspondence which lasted about five or six weeks. The difficulty was to make them know what was wanted. When that was accomplished Secretary Hay thought he would be able to do what we wanted without an appropriation, and I want to see that done. Before this Convention adjourns I want the most emphatic resolutions made in appreciation of what these representatives have done. The people in Washington and the consuls don't understand just what we want in the way of information, and those matters will have to be explained to them more in detail. In their inexperience, however, they desired to do the very best they could do, and most of them sent us long reports containing the information that was sought, but it was mixed up with a great deal of other matter. That stuff comes in here by telegraph or mail, and is turned in in the evening to the editor of a daily paper. There may be a great deal of this matter, and he has got to cut the copy down. Now the young men who do the editing are not expert fruit men, and can not pick out the most salient points. If the matter could be edited by the Associated Press and sent out to the country papers it would be of more benefit. We have not only got to get this information, but to get it where every fruit-grower can get the advantage of it. You have got to get the country papers to demand the Associated Press to send it. This will cost money, and they are disposed, all of them, to cut down their telegraphic messages. If those papers who receive those telegraphic messages know their constituents demand it they will get it for them. This needs the work of a committee to see to the editing of the stuff here before it is distributed, and the members of the Convention don't understand that this stuff costs money. Until it reaches San Francisco it is paid for by the Government; they will not pay for any further distribution of the news. The best plan would be to have the stuff come to us in San Francisco and let us distribute it from here. What we should do to-day is to thank the State Department and the consuls interested for their great service to the fruit industry of this Coast, and next to constitute a committee who has got the time to give a little supervision to the matter and see to it that this news is distributed after it gets here, and that it is cut down and put in a shape so that the people can get hold of that information. And that committee will follow the service up and enlarge upon it wherever it is shown desirable, and from year to year it will increase until it becomes, in my judgment, of exceedingly great value. I think it would be a proper thing to do for the State Board of Horticulture to make a slight appropriation for this purpose, and I believe that the best thing to do would be to turn the thing over to the State Board of Horticulture, which is engaged in some degree with the Department, and whatever expense there is connected with it they are in a position to pay. It will only be a trifle, but it is something to pay for. I hope the matter will be discussed a little bit.

MR. BERWICK. I would like to say this: that in the past the Commercial Museum has done this work for us and has charged us nothing, and they have done it regularly and effectually. It now seems to me hardly gracious to take it from their hands until they are ready to resign it.

At this time President Cooper introduced Mr. Eugene Goodwin, Secretary of the Pacific Coast Commercial Museum.

ADDRESS ON CONSULAR SERVICE.

By EUGENE GOODWIN.

Your committee has requested me to tell you something about the State Department and its workings, and what it might do for the fruit-growers of California.

The State Department is the medium through which the United States has its relations with foreign governments, and of course contains many branches. The principal one in which you are concerned is the Bureau of Foreign Commerce, presided over by Mr. Frederick Emory, whose desires are to help in every possible manner every branch of industry in the United States—fruit-growers, manufacturers, jobbers, and others, and to assist them in obtaining knowledge in regard to foreign markets. This is done through the medium of the United States consuls and commercial agents who are stationed all over the world.

Within the last few years the consular service has been greatly improved, by taking from many of the places the appointment of these gentlemen by politicians. All the consuls and commercial agents have been placed under civil service rules, and they must pass examinations as to their fitness and so forth. In this way a great many politicians have been deprived of situations. I think it may be said without fear of contradiction that within the last five years, particularly, our consular service has very much improved. The gentlemen in Washington who have charge of these matters are very earnest in their desire to help every branch of manufacture or produce in the United States. When your committee came to us last spring with this plan of requesting Government aid in telling the fruit-growers and handlers of fruit in California something about the possibilities of foreign markets, we took up the matter and formulated a series of questions upon the most prominent articles that are produced in California, and forwarded them to the Secretary of State, with the request that certain reports be made upon them at three different times in the year. These were to be, in the main, first, reports as to the crop conditions and possibilities in the early summer and spring as compared with the previous years, and such general information in that direction as might easily be obtainable. Then, next, the size of the crop, etc., and any other changes that may have occurred in the meantime. Then when the first fruits—prunes, raisins, almonds, and walnuts—came into the market, cables were requested at many points in Southern Europe, especially Spain, Italy, France, and Bordeaux, and also at Hamburg, as to the opening prices of these articles. Then, following later, reports by mail as to the market conditions and concerning previous cables, etc.

Of course in starting a service like this the first attempts were somewhat crude, and neither the questions nor the answers just what they should have been; but most of the consuls seemed to enter into the spirit of the thing in a very commendable manner. The Commercial Museum is a new organization and is not yet in full running order. We are very glad to take up this matter and assist you in any way, because one of the purposes of the Museum is for the marketing of the products of California. These reports have now ended, and, as you know, were made up in as many ways as was possible with our limited resources.

This service has been entirely gratuitous so far as the Government was concerned. The only expense has been the cost of cables in getting these opening prices. Just what that is I don't know, because the bill has not been sent to us. A cable code was arranged, so that these reports were sent in a very few words. We are very willing to continue that sort of work for you, provided, of course, that you desire it. However, if the State Board of Horticulture wishes to take it up I have no doubt the State Department would render as efficient service as it does to the Museum. This work comes within the objects of our organization, and we are perfectly willing to continue it. I would suggest that while you are here assembled for the purpose of discussing your business and the enlargement of your markets, especially foreign markets, you should appoint some committee representing the different interests to consider this question very carefully, and to formulate a series of questions which will exactly fit each product, and place those in the hands of your State

Board of Horticulture or ourselves, just as you wish, and place them before the State Department, asking for an extension of the service. This would undoubtedly be given to you, and if the service that has already been rendered to you this summer has been of any material benefit I am sure the second year will be more so. There is an element of uncertainty which our consuls encounter in obtaining this information. In France the consuls had much trouble from the French handlers of fruit. They grew rather reluctant when they found that Americans wanted information about their fruits for the promotion of fruits from America.

I don't know that I can say anything more to you on the subject, except to make a suggestion, and that is that it would be very proper and effective for you and your interests that a suitable resolution should be passed here thanking the State Department for its work, for they are human, and they look for an appreciation of their efforts; and I think that if such a resolution was sent to them by you it would spur them on to do better work with much more spirit, although their spirit has been good as it has been. As you all know, you have many competitors, not only in this country, but also in foreign countries, and if you are going abroad with your products you must obtain the best information as to crop and market conditions. These conditions apply not only to fruit, but also to all articles of commerce which you have to sell abroad, and this information can not be had satisfactorily by correspondence, as some of our people are trying to get it now. If you are going to sell an article in any other State you send a good man to represent you, and abroad you have got to do the same thing. In our present consuls we have got good men. I believe the sale of California fruits will be greatly enhanced if these methods are adopted.

MR. RIGHTER. These cablegrams are free, and yet some one has to pay for them?

MR. EMERY. No, sir; the service of the State Department is free, except that portion of the information that comes by cable; that has to be paid for.

MR. RIGHTER. Who pays for it?

MR. EMERY. The Commercial Museum.

MR. ADAMS. I wish at this time to offer the following resolution:

Resolved, That the thanks of the fruit-growers of California, in annual convention assembled, are hereby extended to the Hon. John Hay, Secretary of State, for authorizing the employment of the consular service for systematically gathering information valuable to fruit-growers; to Mr. Frederic Emory, Chief of the Bureau of Foreign Commerce, who has supervised the work; and to the many consuls who have so cordially responded to our request. And we respectfully request that this service be extended and perfected as experience may indicate as desirable.

Resolved, That our hearty thanks be also extended to the Pacific Commercial Museum, and to Mr. Eugene Goodwin, its director, for its effective work in receiving, copying, and distributing this information, at the cost of the Museum. We desire that the

Museum continue this service for the fruit-growers on such terms as may be arranged between the Museum and the State Board of Horticulture.

Resolved, That this subject be now permanently referred to the State Board of Horticulture, with the request that it will assume a general oversight of these services in behalf of the fruit-growers, and that it make an appropriate contribution to the Commercial Museum toward the expense of the service.

The resolution was adopted by the Convention without reference to the Committee on Resolutions.

MR. NAFTZGER. I offer the following resolution on national quarantine law:

Feeling as deeply as ever the vital necessity for a national quarantine law for the protection of our fruit industry against the importation of fruit or trees, plants, shrubs, vines, buds, or cuttings, commonly called nursery stock, infested with any disease, scale, or insect pest, we, the fruit-growers of California, in convention assembled, hereby give our cordial approval to House Bill No. 96, introduced into the Fifty-sixth Congress by Mr. Wadsworth, and we do most earnestly request all members of Congress from California to use their best efforts to secure the enactment into law of the Wadsworth bill, or one embodying similar provisions establishing national quarantine regulations.

Resolved, That a copy of this resolution be sent to each member of Congress from California.

Resolution by Mr. Naftzger was referred to Committee on Resolutions.

WORK OF THE CALIFORNIA FRESH FRUIT EXCHANGE.

By A. R. SPRAGUE, of Los Angeles,
General Manager of California Fresh Fruit Exchange.

At almost every annual State Horticultural Convention for six years past, the necessity for some organization of the fresh-fruit growers has been most strongly urged. At the convention in Sacramento three years ago the matter passed to the appointment of a committee for preliminary organization, and this committee did considerable work endeavoring to secure a car line to be owned and controlled by the growers, but finally abandoned the attempt.

Again, a call was issued for a special convention of fresh-fruit growers to secure the organization of that interest last year. The meeting was large and enthusiastic, I am told, and appointed a committee to secure organization upon the basis of a contract like that of the Raisin-Growers' Association. This committee did some hard campaigning in the endeavor to so shape things as to do business in fresh-fruit shipping upon that basis. It was a plan, however, that did not very generally commend itself to experienced fruit men as practicable, and so upon the advice of Mr. Naftzger of the Southern California Fruit Exchange and at my strenuous urgency when called into council as one of the temporary directors, the old plan was abandoned and it was determined to take up the work upon the exchange basis, or selling delivered plan.

By this time the shipping season was just at hand, and but little time remained in which to organize the business to take care of the crop now almost ready for shipment; but it was vigorously undertaken by organizing the California Fresh Fruit Exchange and subordinate local associations at a few important places of shipment—among others Loomis, Penryn, and Newcastle, and later on at Rumsey and Placerville. Time did not permit organizations at other places, but carload shipments were also made from Sacramento. Owing to the general failure of early fruit at Rumsey and Placerville, because of the frost, but three cars were sent out from the former place and an equal number from Placerville, although fruit from both places was sent to other shipping points to make up cars. We contracted with the Southern California Fruit Exchange for the use of all of its agencies, so that for the fresh fruit business they were ours absolutely and exclusively, and they received instructions regarding our business solely from our office so as in no way to confuse or mix up the two lines of business. Many of them had had no previous experience in fresh fruit sales, but they had an extensive and favorable business acquaintance with the men in their part of the country who were buyers of fresh fruit, because they had for years been selling these same men citrus fruit, and they were quick-witted, clear-headed salesmen who very soon acquired such special knowledge of the new business as to enable them to hold their own with "the other fellows." Not one single car went forward which did not yield a profit beyond costs of freight and refrigeration, although owing to faulty refrigeration and freight delays the fruit broke down so badly in two cars as to leave little margin of profit.

The business of the California Fresh Fruit Exchange up to the first of November amounts to $208,000 gross, which was done at a total cost, including every expense, of $14,000 in round numbers, including funds now on hand. About 208 full cars were shipped East, and sales were made in thirty-eight different cities—the chief distributing centers of the United States and Canada.

We have refunded to one of our local associations $2,900, the proceeds of savings in purchase of supplies and of charges for car loading, and proportionate amounts also were refunded to the smaller associations.

We have not lost a dollar from bad debts. Our members who have shipped with us for the whole season quite unanimously agree that they have received a net amount for their fruit considerably greater than their neighbors who shipped through commission firms or who sold for cash in the best cash markets. It would be too much to assert that no shipper was disappointed at any time, but to those familiar with the business it will not seem strange that we can not say this. One association sent out only three cars, all in one week and all upon a poor market. One of these cars was met upon arrival by a vicious cut in prices on the part of the agent of an old commission firm. The car could not be diverted, as it was in a railroad pocket, and hence its net returns were not very satisfactory. Another of these cars was badly delayed in transit, and hence arrived in poor condition and sold only fairly well; while the third sold well upon a poor general market. The other shipments in small lots from this association were burdened by excessive local express charges. The same conditions existed with the other small association which was able to ship for but a small part of the season, so that at these points the demonstration has not been fully satisfactory; but at every point which was able to ship throughout the entire season, the unanimous feeling of the growers is that we have fully demonstrated the entire success of the exchange method of coöperation in handling fresh fruits, and so have cleared the way for placing the industry upon a firm, self-helpful basis. Some people may think lightly of this movement because we handled so small a portion of the total output this season. But this is by no means warranted. It would not have been wise to undertake a very much larger business with only a few days in which to prepare for it, on the part of ourselves and of our agents. But with the season's experience and with five months' time in which to get ready for next year's business, we should be able to do with greater economy and success several times the volume of business done this year, and a larger volume with a greater variety of fruit to ship would remove many difficulties experienced this year. The cost of doing the business decreases rapidly as the volume increases.

In this review of the season's work I have taken it for granted that our methods are understood by all, but perhaps a word of explanation may be desirable.

Wherever there is fruit sufficient to enable growers to load a car daily, or on every other day, they may form an association to take charge of assembling the fruit and loading cars. Three or four growers with large acreage may do this, but generally a larger number of smaller growers unite for this purpose, adopting articles of incorporation and by-laws to enable them to do business legally. This association is represented by one of their number upon the board of directors of the California Fresh Fruit Exchange. All supplies for all of the associations are purchased by the central exchange, and full records of every individual shipment are kept both by the local association and by the central office, thus being able to check each other and prevent mistakes. When the car is loaded two copies of its manifest are sent at once to the central office, one tacked up in the car, and one kept on file. The car is then in charge of the central office, which, together with the general Eastern agent, determines its destination and sale. Reports of sales are received daily by wire, and auction sheets are mailed from sales in auction markets. These are at once bulletined to the local associations, so that every grower may know how sales are going day by day. After each sale, the agents remit promptly to the central office, and this then sends to the manager of each local association the individual account sales, with checks for balances due; these, after checking up, he hands to the growers when they next come to deliver fruit. At the close of the season, from the refund paid to it from the central exchange, the local association distributes, in dividends to its members, the money in excess of the amount needed to pay their corporate expenses for the season—a grower's profit, resulting from the economies of coöperation, entirely outside of what they receive from the sale of fruits.

Every possible effort is made to assist growers who may need temporary aid, when this can be extended without risk to the organization· We do not speculate, but undertake to sell the products for the grower with the utmost possible economy and efficiency.

At present, although we have had a most successful season, we feel that we were able to accomplish but a small part of the good which we hope to see secured by this organization; for so long as thirty or forty different shippers are juggling with five thousand cars of perishable products in a hundred various markets, thousands of miles away, each in utter ignorance of the other's destinations and diversions, there are bound to be most serious market interferences, resulting in some places in gluts with ruinously low prices, and in others in famines which most seriously check consumption, so that the business of growing fruit for Eastern shipment, which should be safely profitable year by year, is now but a gamble.

By this chaotic way of marketing, at a conservative estimate we come short, at least 20 cents per box, of the average prices which might be obtained were the fruit to be intelligently distributed by a single agency, careful to see that each market is kept supplied up to but not exceeding its capacity for consumption. This would save to the fresh-fruit growers of California a million dollars per year—a comfortable sum this would be for growers to divide, even in this prosperous season. Such a result will easily double the value of every fresh-fruit shipping ranch, and its prosperous tide would be felt in every channel of trade on the Coast. Now, fellow fruit-growers, why not proceed to accomplish this? The coöperative path lies plainly before us. We need but to go forward in it to reach freedom and safety. For years the fresh-fruit growers have been told that the exchange methods which were conceded to be successful in marketing citrus fruit could not be used with fresh fruit. The Fresh Fruit Exchange has this year shown beyond question, in times of good markets and of poor markets—for we had such in the Salway season—that this plan is admirably adapted to fresh-fruit marketing.

It is true that the friendly business relations existing between many growers and the commission firms that have loaned them money and shipped their fruits make many men hesitate to break away from such firms; we must respect such feelings, but question their judgment. However, rather than that the fresh-fruit interest be barred from such great success by friendly considerations for these great shipping firms, it would be better to pension them off with a few hundred thousand dollars per year, simply to keep out of the way, for even then the savings would be so enormous that such payment would hardly be felt. But of course they would not take such an attitude as that, for they are managed by able business men, who would easily find another field of action.

Again, many growers whose hearts are with this movement are so tied up by small loans, all too easily obtained from commission firms, that they can not ally themselves with the movement. This is a most serious condition—one of practical peonage in many cases—and it must receive the most careful consideration of all who are interested in the future of the fresh-fruit industry.

Some means must be devised by which such men may be helped to free themselves. And some way will be found to do it; but for the present we must rely mainly upon those growers who are now free to follow their own clear judgment as to methods of marketing fruit.

In each community that ships fruit, some man there should be clear-visioned enough to see the advantages of such coöperation, and unselfish enough to be willing to start the movement in his own neighborhood. Every such one will receive prompt assistance from the Fresh Fruit Exchange, but without such local initiative we shall be able to extend these organizations but slowly.

Coöperation is the one thing needful; the one condition absolutely essential to the development of the fruit areas of the State, for in no other way can we survive the competition in Eastern markets threatened by the immense areas now being planted in favorable sections of the East; and it is also the only way in which we can secure from the giant corporations, which nominally serve us but actually dominate us, concessions such that, year after year, we may have some fair share of the products of our labor.

At this time Mr. Alex. McAdie appeared before the Convention and extended a general invitation to the members of the Convention to visit his offices in the Mills Building, San Francisco, and that he would there discuss with them the frost problem.

MR. BERWICK. Mayor Phelan was here yesterday, and he stated to us that they were killing "Jack Frost" in France by firing cannon at him. I would like to have your opinion on that, sir.

MR. McADIE. That is an expert question, and it will take a long time to answer it. I will say, however, that we place very little reliance on the cannon-shooting question.

Upon motion of Mr. WILLIAM JOHNSTON, the thanks of the Convention were extended to Mr. McAdie for his appearance before them, and for the kind invitation to visit his department and offer enlightenment on the frost question.

Upon motion of Mr. JOE WALDROP, an invitation was extended to Mr. McAdie to speak to the Convention for one hour upon the question of frost, which invitation he accepted.

THE RAISIN INDUSTRY.

By M. THEODORE KEARNEY, of Fresno.

The truth is, that when a request was made of me for a paper on the raisin industry before this Convention, I was engaged in the occupation of selling raisins at a very serious loss, and I feared to express my feelings at that time lest I might say something I wished I had not said, and therefore I replied that I could not see my way clear to prepare a paper for the Convention.

I realize the necessity that we are under to obtain facts and the experiences of all in dealing with this subject of coöperation and the marketing of our fruits, and perhaps I might state one or two experiences, if you have time, on that point.

There are two classes of fruit that we have to deal with, and I think they need to be dealt with in an entirely different manner. One is fresh fruit, or the perishable article; the other is the dried product, which might also include such products as olives and olive oil, and of course all the dried products such as apricots, plums, peaches, and raisins, and such things as can be carried over and need not be forced upon the market. I was very much interested in listening to Mr. Sprague's report on the operations of the Fresh Fruit Association this year, and of course we know of the successes of Mr. Naftzger and his association in the marketing of citrus fruits. It appears to me that both are on the right road in the handling of those products. The necessity there is to find an immediate market, or else we might have on our hands fruit that would spoil. But in the handling of prunes and raisins and other dried fruits we are not obliged to sell at once. And I have from the first been firmly convinced that if we could go into the markets and say to the dealers, "Here is a product that you need, one that will be wanted all the year round, one that we can carry if necessary and supply to you as you need it, and that we will hold the price of it and sustain the market for it, not at excessive rates nor yet at a price that will give us no profit," we could greatly increase the sale of our product and get a satisfactory price for it. To be entirely successful looks to the fixing of a price and the maintaining of that price in its distribution. Now, in order to do that we must have organization among the growers; in fact, organization is required for all our purposes, whether in dried or fresh fruits. We must have strong organization, and a foundation for that organization that will have strength.

I have been here in San Francisco working on this matter for the last few days, that is, to know in what manner we can draw and secure a contract which will bind the grower to deliver his fruit as he promises, and will yet be free from objections in the nature of trusts. There are laws on our statute books which say, "You shall not form a trust which will interfere with the free marketing of products." An individual may do that if he owns all the property that produces the article which he has to sell. The Standard Oil Company may buy up all the wells in the country and all its distributing agencies and can say, as it is an individual, the price shall be thus and so, and they succeed. But the law contains a number of forms whereby individuals can not come together and do that same thing. We unfortunately are a multitude, and have to deal with the property of the different owners—a great many items of property. A few—twenty or thirty or fifty or one hundred—manufacturers can get together and fix their shares and sell whatever they have to sell at whatever prices they desire, but it is different with us in putting our farms into one company, and for that reason we can not fix a price. The law says, "You shall not, as individuals, form a corporation" and do what the Standard Oil Company is allowed to do. That is where our trouble begins. We must have organization, and we can not depend entirely in that organization upon the bond of honor. In our discussions in San Francisco we have heard a great deal about the bond of honor. I can say for our Fresno growers that a great many lived up to their contracts. Seventy-five per cent put their crops in the association this year when they were tempted by higher offers to sell on the outside. There is a minority, however, and it takes but a small minority to demoralize the market when you say the price shall be so and so and the article shall not be sold for less. As an illustration, you take the raisin-growers' crops. We have three or four thousand carloads of raisins to sell; the association may have thirty-five hundred carloads under its control. The other five hundred cars may be on the outside offered for sale by the commission man or packer or by the growers themselves. There may be a dozen of them to handle that five hundred carloads. On general principles, the Eastern man doesn't believe that the growers can get together and stay together, and then he is offered a portion of those five hundred carloads, and he is offered them by a hundred different men, and his suspicion is confirmed that instead of our having seventy-five or eighty per cent of the growers, we have not got fifty per cent, and that it is therefore not safe to buy from us. There is where the mischief of the minority comes in. Some of the growers at the last annual meeting, in fact the whole of them, instructed their directors to handle this season's crop in this way. If the growers on the outside insist on staying out the association directors shall cut the prices and meet every cut that is made by the outsider. We have an expression that "the association has held the umbrella for the outsider." This cut was the instructions to the directors. Well, in addition to that difficulty, we had to deal with the decisions in the prune cases. As you all know, the Prune Association adopted the Fresno Raisin-Growers' form of contract, and in the litigation the courts declared that the grower was not bound by the contract to deliver more than two per cent. I believe the Prune Association declared that the association should have two per cent for handling the fruit, and if the grower saw fit to deliver two per cent he could deal with the ninety-eight per cent as he pleased. That left the weak-kneed grower who joined the association practically free to sell his crop outside if he wished to. I saw the danger in that condition, and I brought the matter up before our directors and growers, and I asked them to abandon that contract, and to have a new contract signed, and the form of this later contract would be the leasing of the vineyards to the association. The most absolute combination is the Standard Oil combination or the Steel Trust. It consists of the purchase, absolutely, of the properties; but that is not feasible with us. The next step is a lease; we thought that if we got a lease and allowed the grower to work his place under contract with the association we would have control of the crop. The title to the crop was what we wanted. That was a radical step, and it frightened some of the growers, but there was no cause for their being frightened; there was no injury to their title to the property, for the property would sell twice as readily and for twice as much as without it. They hesitated. Then again, some of them said, "My neighbor on the outside got more out of his crop last year than I got, and I am going to stay on the outside too."

The result of it was that on my return from Europe, where I went for the summer, I found that there was only twenty per cent of those signed after three months' work. We undertook an active canvass and worked the number up to sixty per cent, and the other forty per cent remained on the outside. There were seventeen concerns on the outside seeking to make contracts with the growers and buy the raisins from the growers. There was but one step to take that I could see if we were to save any semblance of an association, and that was to smash the market of the outsider right then and there, and prevent him from selling his product at any price until we made an effort to draw those growers together. I announced to the trade in the East that the growers had authorized the directors to cut the price to 2 cents per pound in the sweat-box if necessary, in order to meet competition on the outside, and of course the trade at once withdrew from the market, and the sale of raisins was absolutely checked. We then started in to see if we could get those contracts signed; but the effort failed and we got only sixty per cent, and we marketed our crop at a reduced price. We should have got at least for this year's crop 4½ cents a pound; the growers will get about 2¾ cents; that is the result of their failure to come together.

Now, after that experience I suggested that those who were willing to sign a lease could do so and form an organization—put their crops under the control of the association in the form of a lease; and those who will not do so, that they be invited to sign a contract for three years, agreeing to sell their crops to the association at a fixed price. It has been suggested to them that the association could pay them 4 cents a pound in the sweat-box for their raisins if all will sign. Of course, it is impossible to expect all to sign. Then I proposed to suggest to them that if 95 per cent will sign we will pay 4 cents. This is the latest suggestion we have to make in dealing with the marketing of our crops: If we secure control of 75 per cent we will agree to pay cash on delivery at the rate of 3 cents per pound for the raisins; for 80 per cent we will pay 3¼; for 85 per cent we will pay 3½; for 90 per cent we will pay 3¾, and for 95 per cent we will pay 4 cents. The object of that scheme is to make it to the interest of every man to pool his crop, whether he likes the association or not. I have little hope of securing a contract, under the present condition of things, which will hold the growers whenever they desire to stay out. We run up against the trust idea every time, and it seems to be an impossibility, under the present law, to devise a contract which will absolutely hold the growers if they don't care to be held. Now this sliding scale is introduced to make it to their interest to put their crops in absolutely, and we hope in that way to bring about results.

What I wish to call to the attention of this Convention is this point, and I think the Convention should take some action in the matter later on: As I have suggested, the Standard Oil Trust, the Steel Trust, and many other corporations merge their property into a single individual and thereby take charge of their products, and by which they are enabled to fix such a price as is satisfactory to them, and we, the consumers, are obliged to pay those prices without this protection. Now, in what way can we get even? You can not compel them to reduce their price. We must have their products, and I see no other way for we who are producers than to put our product upon an equality with theirs, and then we will have an even chance. I see no other way than to raise the price of our product upon an equal basis with theirs. To do that, you should have a law that will bind and hold the growers together, whether they like it or not, after they once sign. It does seem to me that it is necessary to go to the Legislature and ask that a statute be drafted giving producers power to form such organizations, and in such a manner that the courts will not declare them in opposition to public policy. That is one of the most important matters, I think, we have to deal with, as fruit-growers in California. It applies, as I have said, to all such products as should be handled by fixing the price and maintaining a market. It does not necessarily apply to the producers of deciduous or fresh fruits or perishable articles, but it does apply, and is necessary, where you seek to fix a price and maintain it, and a very large part of our productions is of that character. This would not only apply to fruit products, but it would apply to every other product that California is capable of yielding to this country. Our wheat-growers are endeavoring in some way to put their business on a paying basis, and such a law as this would also be the means of helping them out.

I would suggest that this Convention recommend to the next Legislature that it pass a law which will enable the fruit-growers to form an organization which will not be in opposition to the law of the land, and which will enable them to stay together.

MR. RIGHTER. I would like to know if the reason these people won't come in is because they have not got the money, and they don't see any means of coming into the association?

MR. KEARNEY. In answer I will say that we have established a system in handling our products by which the grower makes a draft upon the association, payable out of whatever funds are received by us from the sale of his crop. That draft he can cash at any bank or he can get it cashed by his bankers who are handling his property, and, therefore, there is never any trouble about his getting, say fifty per cent of the value of his crop advanced, and very often seventy-five per cent of the value of his crop is paid to him in advance of its being sold.

DR. SHERMAN. I want to correct a few impressions that you might get from the talk by Mr. Kearney, and I speak from the standpoint of the grower. We believe that this organization can be kept intact if the right policy is pursued, and it is simply, in my judgment, and in the judgment of the growers with whom I have conversed, a matter of difference in regard to the policy of the association. And to demonstrate to you the loyalty of the growers and their desire to stand by the association and to preserve its integrity and its organization, I will say to you that they unanimously this year were of one opinion and of one desire to maintain the integrity of the organization; and as a demonstration of their loyalty, they delivered their raisins to the association this year when they could have had a higher price on the outside. I was offered 4 cents for my raisins on the outside for the whole crop in the sweat-box, and I delivered them for less than 3 cents to the association; and at the same time there was no temptation for me to sell them on the outside, for there was a moral obligation to sell them to the association. I believe that was the sentiment with all the growers in the association. The differences have been with the methods that have been pursued by the organization in the matter of changing the original contract to the New Jersey contract. I know, by speaking to the growers and by being a grower myself, that they are unanimously of the same opinion in their desire to hold together this organization. Mr. Griffiths, one of the largest growers in Fresno, said he didn't believe there was 1½ per cent of the raisins outside of the association this year. This year the conditions were good for obtaining a high price—a good price—for raisins, and in order to force the growers to sign this New Jersey contract which was objectionable in many respects, and in order to punish the outside packer and in order not to hold the umbrella over him, the raisins were put down to a lower figure. After Mr. Kearney came from New York he said he proposed to break the market and put the price down to 2 cents, and the market was broken. It was generally supposed that if this course had not been pursued the trade would have taken all the raisins and taken them at a good price.

MR. DORE. Now, in reference to this memorial to the Legislature. I am heartily in favor of it if it applies to coöperative organization. The California Raisin-Growers' Association was a coöperation for the growers. If the contract can not be made strong enough for that organization to hold the crop, I am in favor of having a law that is strong enough to hold the organization, so that we won't have to go to New Jersey for a contract to hold the producers of California.

The Convention then adjourned until 1:30 o'clock P. M.

AFTERNOON SESSION—SECOND DAY.

WEDNESDAY, December 4, 1901.

PRESIDENT COOPER. I will announce the following committee to prepare a resolution to President Roosevelt indorsing his message so far as it concerns the fruit interests of California:

First, the favorable attitude regarding the interoceanic canal;

Second, the great interest manifested in the irrigation problem of the great West, with forest preservation;

Third, the consular service in the interest of the producers;

Fourth, the Pacific cable.

On that committee I will appoint F. M. Righter, Hon. William Johnston, and N. W. Motheral.

THE CALIFORNIA WINE INDUSTRY, ITS FUTURE, ETC.

BY W. J. HOTCHKISS, OF HEALDSBURG.

It is not my purpose in this article upon the future of the wine industry of the State to go back and give a history of the rise of the viticultural industry. What I desire to draw attention to is the line along which I believe the cultivation of the vine and the production of wine can be carried out for the best interests of the State.

An industry is of profit to the State to the extent to which it gives remunerative employment to the people and profitable returns for the capital invested. I believe that the wine industry of California should be directed to the extent of large productions and larger distribution rather than to the production of small gallonage of fine wines at prices which would forbid their use except among people of independent means.

As fine and as good wines can be and are produced in California as anywhere in the world, whenever we take the time and expense to do it, and it is as well that a certain number, or a small percentage, of the wine-makers forward their efforts in this direction. But these fine and high-priced wines only represent a small percentage of consumption—we would say, in a rough way, five to ten per cent; therefore, the efforts in the production of wine should be directed along the line of the production of the ninety to ninety-five per cent which goes to make up the bulk of the wine produced.

It would seem a pity to divest the wine and the vine of the romantic and poetic ideas which have from time immemorial been associated with the cultivation and production of vineyards and wine; but the lines along which I think the production of wine should be followed in California should be entirely free and devoid of sentiment and the policy be dictated entirely by the grosser purposes of commercialism. California, in my opinion, already produces the best wine in the world. As a people we have not that patience which would induce us to build expensive cellars and to there store and age the wines for a long period of years, to be afterwards brought out and sold by our children, or perhaps our grandchildren, for their profit. What we want to produce is a wine that is cheap enough and good enough, so that the humblest laborer can have it on his table in competition with beer, coffee, and milk.

Wine-Making.—The wine of California is the best wine in the world for the same reason that we produce better results in all other lines of manufacture. We have a climate and soil equal to any for the production of good grapes. The manufacture of wine is a question of intelligence and mechanical handling. The old idea that around the making of wine there was some mysterious juggling not to be understood excepting through ages of hereditary knowledge is false. Fermentation is a matter of chemical study. The care and preservation of wines are also matters of intelligent understanding and germ annihilation.

Our wine is as far superior to the wine made by the old and antiquated methods of foreign countries as our other products are superior, on account of the better machinery and better facilities which we have. It is only necessary for an observer to go into one of the well-ordered wineries of California with its modern machinery, where nothing scarcely is seen of the grape from the time it enters the crusher until the pomace is carted away, and then to have him go into some winery of Europe, where wine is yet being tramped by the feet from the grape, where the pomace is handled in tubs, and where the general smell of acetic acid and decaying grape stems permeates the whole place, to understand why this is so.

Resistant Vines.—The wine-makers of the State, in order to keep up their production, are now planting resistant vines in large acreages. The three principal localities where wine has been produced in California are Sonoma, Napa, and Santa Clara counties. In each of these three counties the phylloxera has made such inroads that it has in many instances destroyed the principal vineyards, and it is only a question of time, and a short time, when the present vineyards will all have been a thing of the past. In Napa County, where the phylloxera first appeared a number of years ago, the planting of resistant stock has been going on for a number of years, but not attended with very satisfactory results. In many cases where the right kind of resistant stock was procured, it was not planted upon a soil adapted to that stock or the right scion was not grafted upon the resistant stock. The adaptability of stocks to soils and scions to stocks had heretofore been something the vineyardists had known but little about. The last few years, profiting by the experience of the older sections where the phylloxera first appeared, a careful study has been made of the resistant stocks, with the result that now an intelligent knowledge has been obtained by the vineyardists in the different sections, of the resistant stocks best adapted to the locality, and with this knowledge in hand it is reasonable to suppose that in a few years, even in the phylloxera-devasted districts, the planting of vineyards on resistant stocks will have brought the acreage back to that of former years. Added to this are the large plantings in the interior country, principally in the San Joaquin Valley, where the phylloxera has not yet made its appearance to any considerable extent. The area of the San Joaquin Valley is so great that vineyards can be planted at distances so extreme from each other that it would be a good many years before the phylloxera will communicate from one to another, and it is to this section that we now look in the next few years as the source from which the quantity of wine necessary to supply consumption is to be obtained.

The climatic conditions of the interior valleys are such that the very highest grade of dry wines can not be produced, but with modern systems of refrigeration and properly constructed buildings, wine which will be good enough to commend itself to the body of the people as a substitute for beer can be produced at a much less cost than in any other section of the State.

It is the opinion of the writer that the production of both dry and sweet wines in the San Joaquin Valley in the next five years will be such in quantity as to astonish those who have not made a study of the conditions there, and who have supposed that the phylloxera was on the point of destroying the wine industry of California, and thereby raising the price of wine to such a prohibitive figure that the masses could not drink it.

The Outlook.—To those who at this time plant vineyards, whether upon resistant or common vinifera stock, there is a promise of very large returns of profit, and it is reasonable to suppose that it will take at least five years to reinstate the vineyards to their former productive power, during which period the prices of grapes and wine are likely to remain, if not at their present very high value, at a good figure.

PROF. HILGARD. Mr. Hotchkiss has not told us whether he thinks it advisable to plant non-resistant stock or resistant stock in the first place. I wish to warn those who are going to plant that it is not the insect itself that carries itself by its wings, but it is a connection between them. It is not safe to plant non-resistant stocks to-day. I believe that north of the Tehachapi it is hardly advisable to plant a non-resistant vineyard anywhere. For my part I certainly should not advise any one in the San Joaquin Valley, or anywhere else, to plant non-resistant stocks at this time. I would emphatically warn all growers not to rely on any stock that comes from uncertain sources. There are a few places in this State where you can get the best resistant vines, and I emphatically warn the growers not to incur the uncertainties that have befallen them before. The uncertainty as to the exact stocks to be planted is very great, and then the soil differs greatly. As to the adaptation of the different soils, it is a matter that is yet uncertain. I should long ago have planted an experimental place to determine this. I don't think any one in the region of the San Joaquin can afford to plant anything but resistant vines. There is no reason why we should experiment, except with reference to the soils. We can take the experience of the vineyardists of France with their vines. I grafted, on account of the difference of soils in our vineyards in San José, part of the vineyard in Riparia and part in Rupestris. Those that I grafted upon the Riparia gave a good crop. The Rupestris is one of the small growers, and the Riparia one of the larger ones. Don't plant miscellaneous stuff, the adaptation of which no one knows, or you will suffer the loss that they suffered in early times. I know a great many think that everything has to be done over again in California, but so far as this point is concerned, Southern France has given us what an experience of thirty years has added, and I think we ought to avail ourselves of it.

MR. HOTCHKISS. I believe the only way we can keep up the present production is by the planting of the Vinifera stock on rich land. Find a good piece of land that will produce four or five tons of grapes to the acre, not right up against the phylloxera vineyards, but the State of California is so big that you can get twenty-five or thirty miles away from the phylloxera—out of the winds of it.

PROF. HILGARD. In order to keep up the production I think we can safely rely upon a few of the standard varieties of resistants—the Rupestris St. George and the Riparia.

MR. HOTCHKISS. There are not enough of those to go around, though, and it will be years before we can get enough of them.

PROF. HILGARD. If you graft those resistants on good vines you will soon get cuttings enough.

MR. MOTHERAL. We have an irrigated country, and the water all over it is from four to six feet, and we have a soil that we have dug artesian wells all over it and have never gone through it. Now what would you plant there—Rupestris or Riparia?

PROF. HILGARD. Riparia.

MR. MOTHERAL. If we don't get the wind from the phylloxera, do you think we will be affected with the phylloxera under those conditions?

PROF. HILGARD. In Fresno, last year, we tried to capture the phylloxera, but we could not find it. It is possibly scarce there. In the ground where sub-irrigation is carried on I think we will find it. The surface roots are apt to bring it about. The wings form more readily there.

MR. MOTHERAL. Are there some parts of France where you find our phylloxera?

PROF. HILGARD. Not in France, but probably so in Germany.

MR. MOTHERAL. Is it the condition of the soil?

PROF. HILGARD. No, not exactly. It is mainly a fact that the insects can not migrate in sandy soil; the sandy loam can not be relied upon. In Germany it is quarantined.

MR. MOTHERAL. We have just such a quarantine in our county. We don't allow rooted vine cuttings or anything of that kind to come in. Will such a policy as that protect us any length of time from the winged family?

MR. HOTCHKISS. If a wagon comes from Fresno and brings you a load of raisins and passes through a vineyard and takes up the surface soil it is apt to bring phylloxera.

MR. MOTHERAL. We are of the opinion that there is none of the winged form in Fresno. We can not find any indication of it, or of the gall form either. If we don't get the winged form we hope to escape.

MR. HOTCHKISS. Regarding the quarantine: I am often asked the question as to how the resistant cuttings are disinfected. Now, there is no difficulty about that at all. If you place the cuttings in a vessel that is air-tight, and fill the vessel with the fumes of bisulphide of carbon, and let the cuttings remain there for twenty minutes, every phylloxera germ will be killed. Just pack your cuttings into a dry-goods box and set therein a saucerful of bisulphide of carbon, and let them remain there from six to twelve hours with the box closed.

PROF. HUSSMANN. Mr. Hotchkiss says there is no trouble with Vitis vinifera vines, and that if you put them on rich soil they will live for five or six years, and give abundant crops. I differ with him. I think that the phylloxera in an infested district would prevent them from bearing at all before they were exterminated by the insect. Another thing in which I differ with him is that he says five per cent of fine wines are enough for California, and that everybody should strive to make common wine. These cargo wines will never establish the reputation that California ought to have for fine wines. I think those wineries which make up small quantities, not to exceed fifty thousand gallons, and make it under the personal supervision of good wine men, will always have to be relied upon for making the reputation of California for good wines, while the cargo wines, as they are commonly called, will never make any reputation. They may be a good drink for common people, and may sell at low prices, and large quantities may be sold, but they will never establish such a reputation for California as it ought to have. I can not see why those men of small wineries are not greater benefactors to California than those who make three hundred thousand or five hundred thousand, or even a million gallons, because they will have to bring the approbation of the wine-consuming public, and not of those immense establishments.

I will tell you another thing: The wages paid to scientific men who are able to take care of a winery of fifty thousand or one hundred thousand gallons are altogether inadequate. I knew of one instance, several years ago, where a foreman of a ranch in Napa County received $35 a month salary, and his board and, of course, quarters. They had a fine cellar built there, and three hundred and fifty thousand gallons of wine were made that season. The wine was made sour from one end to the other, and had to be distilled. Wouldn't that vineyardist have been wiser if he had paid a wine-maker $100 a month and turned out fine wines? What can you expect from a man that gets $35 a month?

I differ with Professor Hilgard in certain respects, too. I don't think we can depend altogether on French methods here, for the simple reason that our climatic conditions are entirely different, and our soils are not always up to the French standard. And therefore we must experiment for ourselves and find out what is adapted to our soils. I notice that phylloxera spreads much more slowly here than in France. Whether that is owing to the absence of the winged form or some other form, I don't know. In France they class the Lenoir as one-twelfth resistant, and the Scuppernong as one-twentieth. We will note that the latter is of no value here. First, it will not grow from cuttings; second, it will not take the graft; and third, it will not bear in this State. What is the use of mentioning such a vine at all? We can not do anything with it. Yet, what I think makes the difference between here and France is the difference of climatic conditions, and perhaps our vines do not suffer so much from the attacks of phylloxera—at least some varieties do not. Wherever I saw young vineyards established on young Lenoir roots in Napa Valley I found that the vines flourished in the highest degree and were making splendid growth, and I could see no material difference between the different varieties. They showed the difference in the foliage so I could tell them apart easily, but they all seemed to flourish well. I don't think it will be well to depend altogether on French authorities. We have our own row to hoe, and the sooner we do it the better. The resistant vine is the only true remedy against phylloxera.

MR. AIKEN. Mr. Chairman, I am like Professor Hussmann, who disagrees somewhat. I especially agree with the paper just read by Mr. Hotchkiss. I have had some experience in vineyarding, where I am raising a table grape worth $100 a ton and am growing it on its own roots. In one vineyard two years ago this last spring it bore enough to pay for its culture. It was the Tokay. With my rich soil I can defy phylloxera, at least for thirty or forty years, and I don't care what happens after that. Let us go on and raise vineyards that will bear large crops, and let us realize money from them. A neighbor of mine has been growing Riparias for years past, and I can grow more grapes on my two-year-old stocks than he can grow on his vines ten years old.

PROF. HILGARD. The Riparias of ten years ago did not bear, but the Riparias of to-day do bear.

MR. STEPHENS. Mr. Chairman, with your permission I will make a statement. I am obliged to beg leave of you to grant your Committee on Transportation further time.

Upon motion of WILLIAM JOHNSTON, Thursday afternoon was fixed as the time for the committee to report.

PRESIDENT COOPER. We will now hear the memorial to the next Legislature, prepared by M. Theodore Kearney.

MR. KEARNEY. I believe it is generally understood, and the feeling is universal among producers, that coöperation is what is most needed in order to gain the utmost success, and for coöperation you must have a foundation. The foundation is in the law which enables you to form your association. That law must be of a character which will assist you in your work and not deter you in your operations. As I understand it, the grain-growers are seeking to form an association in order to market their product so that they will get something out of it. Now, to reach that it is necessary for them to make charters to get their wheat out of here. The men in San Francisco control the charters, and make you pay two prices for having your grain landed in foreign markets. You must have charters for your own vessels. In order to do that you must be sure that you have the control of the crop when it is produced. To control the crop you must have an organization and that organization must be legal, and its action must be legal and just, or the contracts will not be upheld by the courts. It is the same way with the prune-growers. The gentlemen who are managing the prune business are called on to make contracts for the delivery of those prunes by the growers. How can they make a contract for the delivery of those goods unless they know they control the crop? How can they know they control the crop if they make a contract that does not bind the grower in case he is tempted to pull away from the association and sell on the outside?

You see, therefore, it all comes back to your power to control your goods after an agreement is signed to deliver the crop to you. And it is upon these things that the people who manage your business base their action. The law, as it is at present, says this. The grower has signed a contract to deliver his crop; for some reason or other he refuses; you then want possession of that crop. It is not the profit you make in handling it, and it is not the damage you would sustain by not having possession of the crop, but it is to have entire control of the crop that you are after. The courts say to you that your remedy is in a suit for damages. And in the Pool case the association had control of two per cent only, and the court said that the association's damage in that case amounted to $14. What good would that do the directors in marketing that crop? You see you are powerless unless you have a contract on the part of the grower which absolutely controls the crop. We are now seeking in the Raisin-Growers' Association to control the title to the crop. We ask the grower to sign a lease to the association; we ask the grower to work his vineyard just as he did before, and we will give him for his services ninety-five per cent of what he receives for his crop. The point is this: that we want to be in possession, being the owner and controller of that crop and not only the five per cent which we propose to get. We were forced to go outside of this State to find articles of incorporation that would meet all the requirements of the growers.

I will now read this memorial, and I will suggest that a committee of seven be appointed, which will represent the various industries—the citrus-growers, the prune-growers, the almond-growers, the raisin-growers, the wheat men, and all others whose interests would be likely to be affected by this law, so that we will have a representative committee that can prepare a bill to be submitted to the Legislature for its consideration. I may say, in connection with this, that yesterday I was in consultation with three attorneys. Before leaving home I wrote to the Bank of California, the Nevada Bank, and the Anglo-Californian Bank, stating the necessity for a contract to bind the growers, and asked them if they would assist me through their legal advisers in preparing such a contract. I had a session with three of these attorneys during the whole of yesterday afternoon, and I may say that such information as we may get through that source would be very available to the committee, and may be of great help in preparing the bill that the growers need:

Resolved, That whereas our laws, as interpreted by the courts, enable manufacturers and others to form combinations and control prices through a sale of any number of properties to one concern, and that these laws practically forbid the formation of associations of producers for a similar purpose, because it is not possible to vest the title to innumerable farms in one company, and that this condition is a gross injustice to all our producers and constitutes one of the greatest obstacles to the general prosperity of the whole State, in that it compels them to pay combination prices for everything they buy, while preventing them from obtaining combination prices for what they have to sell; and

Resolved, That as it is absolutely essential to the success of our producers that they form associations among themselves for the proper grading and marketing of their products, the Legislature of this State is hereby respectfully petitioned to enact a law at its next session which will effectively and immediately place our producers on an equality before the law in this respect with any and all combinations.

MR. SPRAGUE. I move that the resolution be referred to a committee for consideration and presentation to this Convention when it assembles next year, and at that time let the committee bring in recommendations.

MR. NAFTZGER. I was about to make this motion, but now I will put it in the shape of an amendment to Mr. Sprague's motion; that is, that a committee of seven be appointed to which the memorial will be referred, and that the committee be instructed to report to the next annual Fruit-Growers' Convention such recommendations as they deem wise in the form of amendments to our coöperative law.

Amendment carried, and the resolution adopted.

RESOLUTION INDORSING HON. J. A. FILCHER.

The following resolution was offered by MR. NAFTZGER in regard to the appointment of Mr. J. A. Filcher as Chief of the Department of Horticulture at the St. Louis Exposition:

WHEREAS, The commissioners from fifteen States and nine foreign countries, represented at the Pan-American Exposition, recently held at Buffalo, in the State of New York, have united in recommending one of California's citizens, the Honorable J. A. Filcher, for Chief of the Department of Horticulture at the forthcoming Louisiana Purchase Exposition, to be held in the City of St. Louis, State of Missouri, in the year 1903; and,

WHEREAS, The recommendation has been indorsed by thirty-six out of thirty-eight exhibitors in the Department of Horticulture at the late Pan-American Exposition; therefore, be it

Resolved, That the fruit-growers of California, in State Convention assembled, recognize and appreciate the compliment to our State and one of its citizens, and most heartily unite in recommending Mr. Filcher for the important position named; believing that his identity with our interests, his long residence in California, and particularly his very extensive and successful experience in exposition work, both in this country and in Europe, coupled with his recognized energy and executive ability, mark him as the man in all the West, and, for aught we know, in the country at large, most eminently qualified for this distinguished and very important position. We believe that his appointment would not only be a guarantee of energetic and efficient work, but would carry with it the assurance that at St. Louis, for once in the history of expositions, the great and rapidly growing horticultural interests of the world would receive the recognition their importance demands.

Resolution adopted by a rising vote of the Convention.

MR. FILCHER. It has been my misfortune, or fortune as the case may be, to be absent from home a great deal; last year in Paris, and this year in Buffalo. If I was easily impressed, I might be on this occasion—being called on immediately after hearing read that resolution in my behalf in connection with a movement which was started without any effort on my part, among my fellow commissioners at Buffalo, in favor of my selection in St. Louis for the position of Chief of the Horticultural Department. I was given to understand in St. Louis last week that there is no reason why I shouldn't have that position if the people at home wanted me. They recognized California as the leading horticultural State, and that our horticulturists are advanced in their pursuit, and they believed that some advantage might accrue to their great enterprise by distributing their executive officers to the different parts of the country. I will say that they are planning to make the St. Louis Exposition one of the largest ever held in the world. To give you an idea, there was about $10,000,000 expended at the last exposition in Paris in construction, and nearly $9,000,000 for the same purpose at Buffalo, and at the Columbian Exposition in 1893 $18,000,000 was spent in construction, and St. Louis contemplates an expenditure of $30,000,000 in construction. The World's Fair at Chicago occupied between six and seven hundred acres, and St. Louis has set aside about twelve hundred acres. They believe confidently that California will be there in some shape, and they feel that we are awake to the fact that we are handicapped for the reason that our Legislature does not meet until the January before the opening of their exposition in April. They depend upon the ingenuity of the Californian to overcome this difficulty. You will be surprised when I tell you that our work at Buffalo was accomplished, good or bad, as you may judge it, for considerably less than $10,000. Missouri, with its exhibit right opposite us, and with $75,000 behind them, looked over at our show and said, "Well, you Californians always have lots of money." But we never told them how little we had. There were a great many things that worked to the deteriment of the Exposition at Buffalo; if I should undertake to give you even a synopsis of them it would be tedious. There was one instance of exceeding sadness: It was the assassination of our noble President at the hands of a cowardly villain. It did seem to some of us people on the ground that to some extent the Buffalo Exposition, in spite of all its grandeur and magnificence of structure, was for some reason hoodooed.

I was the first exhibitor to begin work in the Horticultural Building, and worked almost day and night in order to be ready to open on the 1st of May, and yet, on the 26th, 27th, and 28th of April it snowed continuously. Eighteen inches of snow lay on our roof, and when it began to thaw and slide off to the dome of our beautiful building it hit on the glass, and when I went out on Sunday morning, the day before we were to open, I found ice and fruit and glass and snow all tumbled into a pile twenty-five feet high. That was discouraging. But believing, as my father said, "we would never know the difference in a thousand years," we went to work chopping holes in the floor to let the water out, and getting our fruit out of the snow and rebuilding our stands. We were then as far toward being prepared for the opening as some of the exhibitors, and further along than some of them. On account of this excessively bad weather, others were injured as well as the Californians. You remember, perhaps, that it leaked out that the dedication would be postponed until the 21st of May; the inference went out that the exhibitors were not ready, which naturally deterred the people from coming. On the 22d of May the fair was opened, but the people thought there was plenty of time, and they didn't come in large numbers. When they began to come the weather began to get warm, and you know what a warm day in the East is. They say we have got hot weather in California, but when it is warm here it is not that smothery, moist heat which causes your clothes to stick to you like poor relations. That kind of heat we don't have in California; ours is a dry, healthy heat. I know all the kinds of weather they have in the Sacramento Valley, and have run a header in the Feather River country at the time they said it burned the handles out of the axes, and where it was 112° in the ice-house. I have seen all kinds of weather. The people at Buffalo thought we would remain until the hot weather was over. I predicted an average attendance of 100,000 a day, and I was gratified to notice the attendance swelling up with the approach of cold weather to from 75,000 to 90,000, and it looked as though my prediction was going to be realized to the fullest extent, when all at once the saddest occurrence that has taken place in the country for years came to pass in the assassination of President McKinley, and the attendance dropped from seventy-odd to thirty-odd thousand, and in spite of all advertisement and inducements to people to come, they would not come. The Exposition is short about $300,000.

I want to say to you people that from the California standpoint it was a howling success, or to put it more gently, it was a great success. Ours was a profitable exhibit. It provoked very favorable comment. It was talked about in the exhibits, and around the halls, and by the visitors as "something you must be sure to see." I remember one evening on the cars a gentleman said to me, "Do you know whether this car goes to the Tift House?" And I said, "Yes." He said, "They have got some fine exhibits out there." "Yes, very good," said I. He said, "California's is fine, isn't it?" "Yes; where is that?" said I, and he directed me to it, and I told him I would try and see it to-morrow. He said, "You must, or you will miss the finest thing in the whole show." I said, "Where are you from?" He said he was attending the Congress of Electricians. I then told him I was connected with the California exhibit, and that I was from California. That is an illustration of the interest generally manifested in the show California was able to make.

I was just footing up to-day the results of our awards, and while we do not think we got all we ought to have, California returns with fifty gold medals, sixty-eight silver medals, about the same number of bronze medals, and I forget how many honorable mentions. Altogether, two hundred and thirty-nine awards were made to the California exhibitors, and I think it is fair to say that it is twice as many as were given to any other State in the Union. The awards were made by juries composed of as good talent as could be found in the country, and were made without any possible interference on the part of the exhibitors from California. You hear a good deal about judges being influenced in making awards at the different expositions over the country, but in no exhibit with which I have ever been connected do I know of a case where a juror has been influenced or attempted to be influenced, and I think such an attempt would be injurious to an exhibitor. You show your exhibits, and they make their findings and you abide by them.

Incidentally, I will say that I think the Buffalo field for California is a good one; this is the first chance we have ever had of getting away back before the great masses of Eastern people. We have never been with an exhibit farther east than Chicago. We found that the great mass of the people have only an imperfect idea of the real characteristics of California; we found them susceptible and very eager to learn the facts and particulars. We found a demand for our literature that amounted almost to greed, and I adopted there a different method to any I ever adopted before in the distribution of it, by placing it out neatly along the counter, each pamphlet by itself, so that the inspector could see what we had, and allowed the visitors to take what they chose, instead of having some one in charge of it and asking the visitors if they wanted some of this literature. I found that where you allow them to take what they want and only what they want, they will put it away and take it home. To prove that this is the best plan in distributing literature, I will say that I never found a single scrap of our literature about the walks on the ground, while they were littered with advertising cards and scraps of paper from all over the grounds. Many times we looked to see if there was any of our literature scattered around in the scrap piles, and with the exception of some cook-books which were handed out to every one who sampled our fruit, we failed to find anything. The visitors would take those books because they had been asked to, and did not like to refuse our courtesy. I believe that if those books had been left to be taken by only those who wanted them, none of them would have been thrown away. We found that the demand for California literature increased. The problem that presents itself to us is how are you going to get your matter in the best hands and get it there without being wasted. The Buffalo Exposition was a rare opportunity; we put the matter in the best hands, and none of it was wasted. Last summer we distributed in pamphlets about two carloads of literature, and could have distributed four carloads if we had that much. When we add to that literature the coöperation of a fine exhibit, and the constant talking of those in attendance, and detailed explanations among the visitors of matters relating to this State, and the information given by word of mouth and the impression given by our exhibit, I believe that more results than we now anticipate will come to us.

By the support of the California Cured Fruit Association we kept up a prune-cooking booth, in which we demonstrated the cooking of the California prunes, and I was fortunate in getting a woman who could not only stew prunes to perfection, but who made a very tasty prune cake, so that the prunes would show artistically through the cake when it was cut. She made prune pie and prune marmalade, and cooked the fruit in many other ways. They were shown to the people around that stand and given away there. We distributed 2,500 different recipes for the cooking of our fruit. I requested one boy to stand there and ask the people who tasted our fruit where they were from, and in one day there were thirty-eight and the next day twenty-seven different States, and the next day twenty-three or more. The grocerymen were delighted with that prune exhibit, and stated that their sales of prunes increased daily while we were there. Their sales increased from 20 to 150 per cent in the fresh fruit season with our little demonstrating stand there at Buffalo, so you can imagine what could be done by a little systematic work of this kind throughout the country.

As a result of the Atlanta Exposition, a man there had a store and he got his wife to try and cook fruit after the fashion stated in one of our little books, and it was such a success that he is now buying California fruit by the carload. We had similar demonstrations in Germany and in Paris, but were handicapped there because that year Europe had one of the biggest crops of fruit ever known in its history. Everywhere we went there was report of the big fruit crop, and wine was so plentiful that they couldn't find cooperage for it.

You gentlemen meet here and discuss fruit-growing in its various phases, but I say with earnestness that one of the great works of your body is the work of pushing the demand for your product. Your fruits have passed the mark of being a luxury; dried fruits are now strictly commodities; when we were little boys they were luxuries. The successful producers of fruit in this country and many others are pushing their product to the people. Here is California with a fruit product that runs into many millions of dollars, and yet no concerted effort of any great importance is manifested for pushing it to the attention of the world; but you can turn around and see the private enterprise of a chocolate and cocoa firm putting up a building at Buffalo that will cost a million dollars, just for those two articles alone. Whenever the day comes that California exerts a systematic and organized effort, and has people with samples of prunes and apricots and peaches showing the fine qualities of those articles and many others that you cook without any sugar, much good will be done. I bought a little bottle of pickled ripe olives the other day in Ohio. I asked the man if he sold many of these, and he said, "No, not much." I bought some of them to show to the family with which I was stopping, and to teach them how to eat them. After that had been demonstrated to them, the woman said, "You have played the dickens now; we have got to buy olives, and they are a dear commodity." How in the world do you expect to sell your goods and have people come here and hunt you up to get them when there are thousands of people at the other end of the line raising the same things and swearing that they are as good as those raised in California? People have asked me if we raised apples in California. Another gentleman asked me if they were good. I listened to Professor Bailey deliver a very interesting discourse on California before the National Pomological Society, giving his observations regarding this State. He was very fair, and reminded the fruit-grower of the East that California fruit conditions were not so very much superior to theirs, but it was the California fruit-grower himself. He said the difference was not so much in the fruit and soil, but it was in the man, and he cautioned them to take on some of the California enterprise and method in the matter of cultivation and care and bug-fighting.

I heard Mr. Jacobs say yesterday that our canned peaches are not as good in some respects as they used to be. I have heard people throughout the country say that once they got very fine California peaches, but they don't get them now. I believe that some of the canners are getting careless in the selection of their fruits and syrups. You must be honest with the foreigners. Be honest, and present good fruit to the markets where you expect to sell. The same applies at home. You can not sell poor fruit for a good price, and you can not fool the average American customer more than two or three times. You must not claim superiority for that which is not superior.

I understand you have already passed a resolution favoring the action of the people in St. Louis. I think California ought to be there, and be there in good shape. It is going to be a fine exposition, and the world is going to congregate there; the attendance is going to be good. The fruit-growers and producers and consumers will be there from the great Middle States, and there are going to be New Englanders come in from the great places of the United States. If California was as enterprising as she ought to be she would have an exhibit at the great food show of Boston and at the one now going on in Ohio, and at all those places where foods can be brought out prominently. You have either got to send out your own agents, or the fellow that is pushing at the other end of the line will get away with you.

A MEMBER. I was at the Buffalo Exposition, and I indorse everything Mr. Filcher has said. I saw all those things, and I know a lot of good was done, and I believe from what I saw there that we ought to have an exhibit at St. Louis, and the work ought to be started right now.

A rising vote of thanks was tendered Mr. Filcher for his address.

REPORT OF THE COMMITTEE ON LABOR.

ISIDOR JACOBS, chairman of the Committee on Labor, submitted the following report:

The committee appointed at the last Convention to consider the subject of labor, reports as follows:

That it convened shortly after the adjournment of the Convention, and held a conference with the chief passenger agents of the Southern Pacific Company, who promised to put into effect a colony rate for home-seekers, and this rate was shortly afterward put into effect, resulting in bringing several thousand people to the State.

The committee also formed an organization, called the California Colony Association, which was pledged for a period of one year for the sum of over $600 per month, for the purpose of bringing bona fide colonists to locate in this State, which resulted in locating in different parts of California over eight hundred families. They have also been promised by the railroads a further inauguration of the colony rate, which will undoubtedly bring many more people here.

The work done by Mr. Filcher assisted the Colony Association in its efforts, and the committee of this Convention has ceased its labors—the work now being carried on by the California Colony Association.

Upon motion of MR. RIGHTER, a vote of thanks was extended to the committee appointed to consider the questions of labor.

The Convention then adjourned until Thursday, December 5, 1901, at 9:30 o'clock A. M.

PROCEEDINGS OF THIRD DAY.

THURSDAY, December 5, 1901.

The Convention was called to order as per adjournment. President COOPER in the chair.

PRESIDENT COOPER. This morning has been set aside for the ladies. They have changed the usual programme, and have arranged a programme for themselves.

The following was offered by F. M. Righter:

To his Excellency THEODORE ROOSEVELT, *President of the United States:*

We, the fruit-growers of California, in State Convention assembled, send greeting, and beg leave to express to you our unqualified appreciation of the interest your message to Congress shows that you feel in the welfare of the producers of this great country.

Your recommending to Congress the urgent need of the earliest possible construction of the interoceanic canal and the connection by cable of the United States with Hawaii, the Philippines, and points in Asia, also the aid of the Government in the preservation of our forests and the construction of reservoirs and irrigation canals to be employed in the reclamation of our unsettled arid public lands, meets our most hearty approval.

Hoping that the good things in prospect may soon be secured, we extend in aid of these great accomplishments our grateful helping hand.

F. M. RIGHTER,
WILLIAM JOHNSTON,
N. W. MOTHERAL,
Committee.

Adopted, and a copy ordered telegraphed to President Roosevelt.

Vice-President WICKSON took the chair.

W. H. AIKEN, chairman of the Committee on Resolutions, reported favorably on the adoption of the resolution calling for the passage of a national quarantine law; also, on the resolution recommending J. A. Filcher for Chief Horticultural Officer of the St. Louis World's Exposition.

The resolutions were adopted.

Upon motion of Rev. WALDROP, the latter resolution was adopted by a rising vote.

HEDGE ROW VINEYARD.

By MISS LUCY H. HATCH, of FRESNO.

Hedge Row Vineyard, three miles south of Fresno, is notable from the fact that women owned and managed it from its inception. It was established by Miss M. F. Austin, whose energy and intelligence won it success and reputation. Four women—all teachers—formed the company, and upon the opening of Central Colony in 1876, purchases were made until one hundred acres were included. None knew what could be accomplished, as the resources of the valley were undeveloped, and at the beginning all was experimental. The story of obstacles overcome, of failures redeemed, of the care and money expended, would be too long for this occasion. Miss Austin believed that horticulture for women ought to become a business for them as well as for men, and with that idea came to Fresno in August, 1878. A part of the vineyard had been planted two years before, and that year the pack of raisins was thirty twenty-pound boxes; the next year, three hundred twenty-pound boxes. From that time she applied her energy and intelligence to the development and improvement of the place until a home, ornamental grounds, drier, packing-house, and ranch appurtenances were complete. Her death occurred in March, 1889. We labored together from January, 1879, until March, 1889, when the burden of care fell upon me, and further this deponent saith not.

WOMEN'S AGRICULTURAL AND HORTICULTURAL UNION OF CALIFORNIA.

By MRS. EMMA SHAFTER-HOWARD, of Oakland.

The reactionary movement against subjective education as judged by results shows itself in various ways; in none more plainly than in the return to nature and the study of those elemental facts and factors which underlie the art of life and living.

The advancement of women in agriculture, like other evolutionary movements which call for the application of scientific methods and inventions to economics, is in line with truths and realities which result from the nature and relation of things. In this objective movement is involved the expansion and extension of the home idea as a progressive institution, vital to human society in all the phases of its growth.

This advancement is hindered by the gulf which separates the interests of city and country, especially among women; in the isolation of the country home apart from the so-called advantages of the town; and in the greater isolation of the city home in its lack of intelligence and sympathetic relation to its basis of supplies—the country.

It is largely the opportunity of women to throw out lines of mutual recognition and helpfulness, and to stimulate the home up-building of this State. "As a people are helped in their hearts to be brave in the face of difficulties, so they prosper."

The registration of the names of women in California who have entered into horticultural and agricultural pursuits has begun. It is the first important and practical step to be taken. Women throughout the State have been asked to send their names and statements of their special work and methods to the corresponding secretary of the Women's Agricultural and Horticultural Union of California. As this call is answered, there will be an increasing registration, which will lead to a bureau of information and exchange; and to a social organization based upon the natural conditions of our soil and its increase. It will open up and publish to the world advantages and inducements to home-loving, home-making people to come to our State in increasing numbers for suburban life.

About one hundred statements have been gathered, and represent various interests carried on by women, singly or in family relations. The record is remarkable, but far from complete as a directory. It represents industrial effort in homestead extensions from one acre to one thousand acres, yielding support to many families, and better still, making of the family a community partnership. It also shows the tendency toward healthful growth in the diversions of home-making folk, in efforts to beautify and enrich barren surroundings on roadside and in garden.

Other countries are far in advance of us in opportunities for the training of young women as well as men upon these industrial lines—notably England and Denmark.

At the suggestion of the California delegate to the great International Convention of Women held in London, 1899, a Woman's International Agricultural and Horticultural Union was formed. Each of the ten countries represented pledged themselves to organization upon these lines and to report in turn to the International Union. English and Canadian women have organized. Belgium is about to do so—also Argentina.

At the Fruit-Growers' Convention held in San Francisco, in December last, a step was taken toward such organization in California. Its object as shown in the prospectus is: To circulate useful information, to compare methods of different districts and countries, and to encourage and stimulate (*a*) farming, dairying, stock-breeding, bee-keeping, poultry-keeping, etc.; (*b*) fruit and flower-growing for profit; (*c*) landscape gardening, arboriculture, forestry, the management of estates as employers and employed; (*d*) also the encouragement of working amateurs.

To this might well be added the words of Monsieur Henry, of the Société Centrale d'Agriculture, at Brussels, speaking of the Union: "It has practical and social tendencies; 1. To afford enlightenment on the methods of different countries in the agricultural work of women; 2. To make popular such operations, and to retain the young girl in the country, and to provide her there with an honorable means of gaining her living." He also said of the woman taken from town to the country: "She will like it or she will be bored by it; she will only like it on the day *she learns to understand it.* If we could keep the women in the country, it is probable the men would be found there oftener. The projects you have introduced to us under this International Agricultural and Horticultural Union are vast, and their possible utility incontestable."

Meanwhile those who desire to register names and industrial interests will please send to Mrs. Emma Shafter-Howard, corresponding secretary, 1206 Alice Street, Oakland.

RANCHO DEL FUERTE, AND ITS LESSONS.

By MRS. JOHN S. DORE, of Fresno.

The first thing learned from the purchase of this ranch of two hundred and twenty acres was the importance of water. This lesson the padres tried to teach by example. You never find an old mission on a dry hillside, but their American successors have had to learn that land in Southern California without a good water right is of very little value. Another thing also learned was that water is an expensive thing to go after or to develop, so that the first thing for an intending purchaser to look out for is to see that the water is already on the land, that it is abundant, and that the title is unassailable.

Next in importance to the choice of land with water comes the selection of suitable products. Here the custom of the neighborhood is of great assistance. If the soil is good for trees, then what shall be done to supply interest and tax money while the trees are growing? If the trees are far enough apart and the land heavy enough, the choice of crops to be planted between the rows; if not, how much land must be set apart for these requirements? All this has to be gone into very carefully.

On the ranch from which these lessons were learned pampas grass, pop corn, and alfalfa were the temporary crops to be depended upon for living expenses while the walnut trees were young. And it proved that pampas grass paid well and soon, but was hard on the soil; while alfalfa was of direct benefit and enriched the land.

The benefits of this experience of course are for women exclusively, since they are the only ones who admit they need it. But this attitude of humbleness in a woman is sometimes of advantage. When she goes forth in a rural community to make inquiries from her neighbors she will find that they often tell her the truth about what she wants to know. Whereas the man new at ranching will nearly always assume that he knows it all, by intuition no doubt. This attitude gives great joy to the countryman. He never fails to make the most of his opportunity, and the stories he tells are only limited by his hearers' gullibility.

In this quest of knowledge it was learned that opinions are often of great usefulness, advice almost never; because it has happened that enthusiastic but unwary women have been led into wasting their substance on costly experiments, from which the men of the community have derived great benefit without expense to themselves.

In starting out to run a ranch one must be very certain as to finances. It is a safe rule never to borrow money unless to put into the land upon which it is borrowed. This is approved of by money-lenders, and gives the person following it better financial standing. It is also well to state that everything in perfect order helps one's credit wonderfully. The usual idea of a woman's farm is gates off the hinges and everything run down. Such a ranch is not considered a valuable asset. Good housekeeping habits are quite as important out-of-doors as in.

This leads on to the hiring of laborers. A woman who has had infinite experience with cooks and waitresses will find the same problems with orchard hands and stablemen. General inefficiency on the one hand will be matched by lackadaisical methods on the other, and the woman gifted with generalship will find ample opportunity for its application.

But whatever a new husbandwoman determines to do, if she is going to get the benefit by observation of what others have done, she must use reason and experiment in adapting the results to her own needs.

There are scores of don'ts in the business of horticulture; they begin with plowing and planting and lead through irrigation up to pruning and harvesting; and the beginner will be almost sure to get things wrong. Whether there is any text-book of sufficient scope available for immediate use I know not. The university horticultural course may be good, but it requires four years; the horticultural paper is often valuable, but expert testimony from professionals is frequently worse than useless; so one is forced to fall back upon cultivation of judgment and the development of native intelligence to steer one clear of pitfalls.

The first three years spent at Ranchito del Fuerte were busy ones indeed. Between sixteen and seventeen thousand plants and trees were planted, most of them by a faithful old Chinese gardener called Jim. The trees were chiefly walnuts, and should the rows be placed side by side they would reach twenty-five miles.

If there is one trait common to all Southern Californians it is certainly satisfaction with one's own land. This is certainly true of the denizens of Ranchito del Fuerte. This ranch lies on the southern slope of the Puente Hills, once within sound of the breakers of the Pacific Ocean before the trees grew tall; and overlooks the valley of the San Gabriel River. Across, at the point of the gap made by this stream through the hills on its way to the ocean, lie the ruins of the first San Gabriel Mission, from which comes the name of the valley and river. About a mile below our ranch stands the old mansion of Don Pio Pico, the last Mexican Governor of California, by whom all the land in the neighborhood was once owned. It was the smallest and favorite of all his great ranches, his ranchito, and a small part of this dear "little ranch," which then comprised about eight thousand acres, he sold to its present owner. Since 1832 the old Don himself and ourselves have been the only ones in possession. There is indeed one spot on the ranch which has never known a plow until this day.

The valley through which the San Gabriel flows is likened by travelers to those rich valleys of the Orient, especially Palestine. The Oriental corn, wine, and oil are known here, only with a difference. Of corn we chose that with the Indian understanding, the vineyard is fading into the alfalfa field, while we dig for oil instead of growing it; and the olive tree gives place to the orange, and the fig to the walnut.

Our Puente hills are filled with petroleum, for to the east lies the famous Whittier oil-fields, and their derricks take the place of cathedral spires.

We had a chapel once connected with the old gubernatorial mansion, but the derrick is the thing now suggesting worship which is allowed to stand. This chapel, with its frescoes and chime of bells, was given to the roadmaster to make a culvert out of, so that now those going to Los Angeles by the carriage road literally travel over historic soil.

The old mansion of the Governor barely escaped the same fate, but it is now being watched by the Southern California Landmarks Club, and will no doubt be preserved from vandalism.

Across the river on the bluff or mesa is a battleground where was fought the battle of the San Gabriel, and where howitzer shells have since been picked up.

So it is to be seen that in beauty and fertility, romantic interest, and plain every-day utilitarianism, Ranchito del Fuerte is not behind other places contained in our happy valleys of the South Land.

CALIFORNIA WILD FLOWERS.

By MRS. LUCY E. WEISTER, of San Francisco.

There is an important feature in our favored State which is often overlooked in the anxiety to make this the most famous locality for fruits and grain and big trees. We are vain over our acreage of cereals, and swell with pride at the statistics of our orange crops and the product of our orchards and vineyards, while we are prone to ignore the beauty of nature spread broadcast on every hand. We worship at the feet of our great acreage, and forget the generous flora that has enriched our Coast with one of its greatest attractions, whose gifts are free offerings and embellish our land in a way to inspire poets and elicit praise from all, while her sister goddesses must be coaxed and flattered and importuned.

But I will leave it to the fruit-grower and farmer to discuss soil and climate, planting and pruning, battling with pests, and relative methods of thinning and gathering, curing and marketing, and will just give a little plea for the fair but frail creatures which give our landscapes their greatest charm—the wild flowers.

This is a subject worthy of attention, not only on account of the beauty of many of the species, but because there is danger of their becoming extinct. Our valleys and hills, and even the cañons, are being encroached upon to the dire destruction of Flora's beautiful children, who turn up helpless faces to the unfeeling plowman as his horses trample them and the sharp steel severs them from their roots, leaving them to wither and die. It is always painful to witness such a scene, and I have longed for some great-hearted, generous spirit to come forward and propose a plan whereby at least some of the finer varieties might be perpetuated. I believe, however, it belongs to the many and not to the few to accomplish this. If all who take jaunts in the spring-time or trips to the country during the summer would make it a point to secure all the specimens they could, carefully getting the roots or bulbs and transplanting them, they could by degrees make a choice addition to their gardens and conservatories.

From our indifference the years go by and the voiceless appeal is going up from hillside and valley, and our beloved wild flowers are perishing.

The hills surrounding our city afford a greater opportunity than is generally appreciated for procuring a large number of varieties. I have gone out in the morning and returned before luncheon with more than twenty well worth perpetuating.

San Rafael, Sausalito, Belvedere, Haywards, Berkeley, and many other places available for a day's outing possess great possibilities in regard to wild flowers of varied excellence. Quite a number of these are comparatively easy to procure, and grow very readily when removed from their native soil to the garden. The tops may shortly die, but if left undisturbed the roots and bulbs will reappear and frequently grow to be as healthy as when in their homes in hill and dale.

This is the case with the aquilegia (columbine), a flower of rare attributes, which deserves a place of prominence. It might well be adopted as our national flower. There are many points in its favor for this honor. It is beautiful, graceful, and unpretentious. It flourishes naturally in all parts of the United States, whether found on mountain top or in the valley, and even its name suggests the bird of our country.

Many varieties of wild flowers may be obtained from the seed; but that is difficult for people living remote from the habitat of the flowers. A good way is to interest some one living in their locality to watch and gather the seeds and bulbs when they are mature.

Many of the lily family, including brodiæa, fritillaria, trillium, and the superb calochorti, take transplanting very kindly.

There is a long list of varieties desirable for the garden, including godetia, larkspur, pentstemon, cypripedium, azalea, nemophila, dicentra, calandrinia, castilleja, clintonia, collinsia, clematis, cillia, dodecatheon, the charming viola pedunculata, the beautiful iris, and many others. Some of these have already been adopted by Eastern and European gardeners. Why not take some means of preserving them, and not have to send abroad for our supplies after we have exterminated them at home? We all, of course, want Eschscholtzias—or shall I say in plain English, "California poppies"? No collection of wild flowers, I should say no California garden, is complete without this glorious flower with its soft, dainty foliage and incomparable, golden. cup-like blossom. Fortunately for us, it is easy to grow. The seeds may be procured by gathering the pods while they are still green and placing them in a deep vessel to retain the seed when the pods become dry and burst open. The poppy may also be transplanted with success, but it requires great care, unless the plants are very young, for the large plants have very long tap-roots, which if broken will cause them to droop and die. But one good plant in your garden will soon seed your premises and supply your neighbors.

There are many people living in the country surrounded by wild flowers of which they take little heed, so common have they become to them, so they allow their workmen to uproot and destroy the dear little creamcups and graceful brodiæas. If they would only set aside some neglected corner of their dooryard and encourage their children to collect and care for all the varieties in their vicinity, they would be doing themselves a favor and their State a benefit.

What can we do to interest the people in this important subject? Can we not prevail upon some millionaire to purchase a large tract of land, including hills and valleys, and set people to gathering seeds, bulbs, and plants from all over the State and placing them where they would have congenial environments? In the meantime, let us as individuals earnestly exert ourselves to do all we can to preserve the wild flowers.

RANCH LIFE IN CALIFORNIA.

By MRS. EMMA FOX, of Lemoore.

"I look away; no green thing gladdens
My weary eye—no flower, no tree—
Naught save the earth the sagebrush saddens,
The scorched gray earth, that sickens me."

How vividly these lines recall primitive ranch life in California? I have in mind the experiences of a family who left the cultivated East to follow a dream of unprecedented good fortune, fabulous wealth, and abiding health, to the idealized Golden State. Came as thousands of others, with the one idea to reap speedily the magnificent harvests, appropriate the nuggets that were no doubt scattered broadcast, only waiting for New England thrift to gather them in, then return, to enjoy in affluence advantages left behind.

The promised land was reached in the glorious springtime, which "found a land of beauty, and left a paradise." Nature's entrancing panorama, the coloring furnished by wild flowers and waving grasses, was at its best. The land that, magician-like, was to furnish the princely fortune, was purchased from the Government, free from the desecration of polluting hands. The intoxication of the ideal surroundings would have made the absence of neighbors not noticed, but the deluding influence of the mirage made the prohibitive distance a lie. The broad, level plain, all ready for the plow, stood in such alluring contrast to the limited, timber-encumbered tracts of the East, that called for so much time and labor before a crop could be thought of, that the work was entered into with courage and enthusiasm. The venture proved the "castle in the air," the "love that never runs smooth." The crop was put in with true Eastern skill and care; it burst forth in blossom in a most satisfactory way; but the castle fell in a single night. One morning a tremendous herd was discoverd browsing on the well-tilled acres; the result of the labor of months had been swept away in a breath.

The battle then began between agriculturists bending every effort to make the most of the country, and the factor with a barrel of money to control legislation in its own interest, and the burden of fence-building was confronted.

As calamities never come singly, another enemy soon came to the front with its destroying qualities. The remnant of the crop, rescued by eternal vigilance from the invading "herd," soon succumbed to the mericiless rays of the scorching sun. The scenes of bewitching beauty of a few months ago had given place to a brown and arid waste. Neighbors who, under the deceptive atmosphere of spring, could be seen in their own dooryards, now in the glare of the midsummer sun had so retreated that the houses themselves were hardly visible, and the cool courtesy that pronounced the doubtful welcome to their grazing land, not felt under the promise of prosperity, cut now like a two-edged sword.

The case was thoroughly disheartening; the abandonment of it all and a return home was the impulse; but where *was* home? The one time home had been given up for the new venture; there was no money to reinstate it, and too much pride to return to the old stamping ground to begin anew.

Fellow men are none too prone to show the bright side to the unfortunate, so they were greeted on every hand with the assurance, "It is ever thus; sooner or later, if you cast your lot in California, you will come to bedrock."

These apparently hopeless conditions, as is often the case, proved blessings in disguise. The very poverty, poetically called bedrock, and the innate pride that resisted despair were the salvation of the State. Had it been left to the resources of the indolent element found here, its possibilities would never have been known.

This family was only a type of the many who followed. The energy born of the necessities of the case, guided by Yankee pluck and gumption, blazed the way to success, and, when supplemented by the lavish gifts with which nature has supplied this part of the country, that success was made doubly sure. It was not reached at a bound nor by rose-strewn paths. It was a world of experiment; everything had to be learned; new methods had to be employed; but its development and growth were truly typical, for mistakes were made only to be corrected, obstacles met only to be overcome. One of the most stubborn of these was the entire lack of the home-making spirit. Among early settlers the feeling prevailed that California was the place to make money, but not to spend it. Because a family would not freeze in a shanty, a shanty was considered good enough; the artistic was lost sight of in the great race for wealth. As a result, rural districts were most uninviting. It was only when home-loving settlers found that they must stay, and had done work enough for the adopted country to feel it was their own, and its climatic smiles had won their love, that such barriers were beaten down and the fashion of good homes established. And now the ranch homes of California are no longer isolated or unattractive—"the wind has been tempered to the shorn lamb." The widespread orchard and vineyard and tremendous acreage of pasture lands have absorbed and mellowed the heat of the sun, and made the blighting sandstorm a thing of the past.

Ranch interests have kept pace with the progressive spirit that pervades all the undertakings of the State. The petty details that have characterized other new countries, making life a grind, keeping each faction in its own little rut, have been eliminated, which has left every member of the family time to cultivate the inclination for the proper rounding-up.

If the head of the house is taken away, the business is not paralyzed for want of a leader. I have in mind a home left greatly involved at the husband's death. The widow stepped into the breach, by judicious management paid off the indebtedness, saved the home, and made it a shining mark in the neighborhood. It is one case that serves as an illustration. But we are not here to show especially what women are doing. Another home, where it has been my pleasure to be entertained, furnishes testimony in favor of country homes. It is situated ten miles from the trading point, but a telephone line brings it in direct communication. It is approached by an avenue lined with stately trees; the grounds are a bower of beauty and the house a haven of hospitality. The walls are hung with pictures that would do credit to any art studio in the State, the product of the hostess's brush. She showed hundreds of dear little chicks, just released from the incubator that she had sole charge of. She is also thoroughly conversant with the management of the ranch, whose acres number thousands. Through the daily papers, magazines, telegraph, and telephone, the country home is in direct touch with the pulse of the world. I can not refrain from saying that the daily paper, with its corrupting sensationalism, is not the important factor in the ranch home that it is in the city home.

Educational advantages are no longer monopolized by the great centers, and the inmates of the country homes have more time to appropriate them, being exempt from the diverting temptations of the social whirl of the city; in proof of which we point to the front ranks of our colleges, which are so largely recruited from the country homes. The bone and sinew of the professions, which are so preëminently a part of the machinery of the city, is largely furnished by the rural districts.

Although we have made great strides, Utopia is not yet ours. It is claimed that nowhere is there the same opportunity for successful agriculture as here. There is need of it, for there are many leakages that ranchers themselves must overcome. They have not yet awakened to the importance of combination. Ostrich-like, with heads in the ground, they have worked to the one end, each individual making the most of his own ranch, and have not seen the danger closing in upon them. They have, in their single heartedness, been led like lambs to the slaughter, and have awakened only after ranches were mortgaged to further the plans of the schemer. Irrigation canals have been foisted upon irrigation districts at four times their construction price. District taxation, under a law created for the purpose, has increased the rate in some instances two and one half per cent. But these ranchers are being converted slowly to the necessity of fostering the institutions that keep their products within the boundary of their own protection, and of eliminating the power of the speculator. But when the next step in this line of evolution is taken, and the ranchers of our State have learned to stand together and trust their own, as do railroad and other corporations, then we shall have a solidarity that will fulfill the prophecy, and we shall be the empire State of the Union. One historian has said, and we may reiterate, "There is but one California in all the world, and the world is beginning to recognize it."

NECESSITY FOR AGRICULTURAL EDUCATION.

REMARKS BY JULIA SHAFTER-HAMILTON, OF MARIN COUNTY.

My ideas on farming are purely practical. I was left some eight years ago with 16,000 acres of land in Marin County to look after, and the conclusions I have had to reach were reached on a practical basis. I studied and learned and tried to understand. The Shafter ranches at Point Reyes are well known to all men interested in cattle in California, and I speak from the standpoint of a large landowner who sublets, and not as one running his own property. One of the most serious questions with us is how to get men of superior knowledge to run ranches. What is the use of acquiring these superior conditions, if we can not obtain men of superior knowledge? When I took my ranches I had to depend almost altogether on the peasantry of Europe, but I think we ought to bring our own children up to agricultural pursuits. Men are too anxious to get the money out of the land and expend it on the education of their children along professional lines, and are not willing to return anything to the land through the same channels—the education of their boys in agricultural pursuits. It was too easy at the start to extract the money from the land, and thousands of dollars have been taken from it and turned into channels where none of it would return to the land. Boys have been taken from the farms and educated and employed in the cities in less remunerative, and in my judgment far less dignified, callings, for where is there a life with more freedom or more dignity than that of the farmer? Gentlemen, what are we to do in order to bring men of capital back to the country, where they will not be handicapped for lack of funds, in order to bring back the productiveness of the soil? Why is it that most men with capital are putting their sons into the overcrowded professions and mercantile lines, where there is so much failure, and where certainly the conditions do not bring about as normal, as healthy, and as dignified a life? Why are they not teaching them that from which they often have sprung? My father made his money in his profession, but then returned to the occupation in which this rising generation's fathers were interested. Why is it that more gentlemen don't do this? No one who lives in the country and is making money there can help knowing that there is no education too high or qualification too fine to be taken back there. It pays so much better than any other business, if we go about it with the same interest and put our money back into it. Why are men satisfied with such miserable, contemptible lives when they are in a crowded city, when they can have cleanliness, breath, and dignity just outside of the smoke and fumes of the city? I am a city woman myself, but I would not choose the city again. It is a place you can always come back to when you desire it. These landowners should go back to the country and manage their property themselves. Another thing you city farmers should do is to take a human interest in the tenants you have on the farms. It can not be that all the New England farmers are dead or that they are multimillionaires, yet why is it that they don't come and run the country lands as they used to? I have had a hard time in getting help, and more of late years I have favored the Irish Protestants, because they are fine farmers and fine dairymen, and on a whole, good workers. I have got a great many men from the County of Lemar, and find that they have very thoroughly learned what they know. The time of the embryonic state has passed and the time for growth has come, and I believe that if more of the city people would go to the country we would meet on a common ground and both be better off.

MAKING THE MOST OF OUR FRUITS.

By MRS. W. N. SHERMAN, of Fresno.

The papers of to-day have covered a wide field, carrying us back to the women who have won victories in the past. Those treating of the present have told us how to make the ranch pleasant. It seems to be left to me to look into the future. We women can do a great deal to make the ranch profitable by adding to the beauty and finish of the goods prepared for the market. The men are skillful in tilling the soil and in pruning the vine and tree. A few—a very, very few—market the products of the ranch in an artistic package. The most of the fruit-growers merely dump the magnificent fruit into packing-boxes, jolt it into town on springless wagons, often over dusty roads, to be handled by the commission packers and thrown into packing boxes; and if it were not for the railroad inspection, it would be loaded with equal indifference into the cars for Eastern transportation. I used to think it was dishonesty that made this careless packing, but as time has passed I am more and more convinced that it is want of knowledge and the carelessness in little details which are characteristic of this State. We all know that it is easier to hire a good man to drive an eight-mule jerk-line team than it is to engage one who will plow with a single horse in the vineyard, for even our laborers do not like small things. This same spirit enters into fruit-packing.

Personally I have found it impossible to pack the Emperor grapes up to standard without being in the packing-house myself. Personal oversight increases the selling prices from $100 to $500 per carload. Surely this is good pay for two days' work. When not there the packers will slip in fruit that makes me blush when I overturn a crate to inspect their work. What can the Eastern buyer think if he receives such fruit under our brand?

Another serious fault is the crowding of the packers to put up so many boxes or crates in a day. Of course it is possible to have girls who are heedless and also slow; drop these out at once, but never try to drive a woman who is doing careful work—she should be treasured.

All fruit needs careful handling from the beginning. In hauling grapes from the vineyard to the packing-house, we use the large raisin sweat-box, putting two inches of long alfalfa hay in the bottom of the box, then a large sheet of raisin paper. Each bunch is laid down carefully on this soft nest, and only one bunch in depth, so that the bloom is perfectly preserved. The boxes are hauled on spring trucks to the packing-house, and piled for the next day's packing, usually twenty-four hours being allowed for the stems to toughen and lose their crispness. The size of these boxes makes it necessary to have two men to handle them to prevent them from jamming.

The grapes reaching the packing-table, the girls first pick out the cluster fruit. Bunches that are absolutely perfect in size of berries, shape, and color, that weigh five pounds, are packed as Imperial clusters in quarter crates. The fancy cluster comes next in grade, and are only a shade less perfect. Next comes the regular cluster, usually bunches that, if they are red, have a few small berries, or that may be perfect as to berries, light or dark Emperors not true to color.

No bunch of less than a pound should go East. For this reason, we do not altogether favor the use of the form, as the temptation is greater to clip up the bunches in order to make a smoother facing.

These methods of careful picking and handling should be followed with canning fruit. The same careful handling, grading, and culling apply here, and after the fruit has been peeled and cored, the most delicate system of trimming and selecting should be practiced, in order to make the fruit of the highest possible grade and quality in its particular class, and to have the pieces uniform in size, color, and appearance, when it is emptied out of the can for sampling or inspection. We have found by experience that honest, careful, and artistic packing pays well in dollars and cents, and returns interest value, by way of increasing the quality and reputation of the brand. This experience refers particularly to the packing of table fruit, canned goods, olive oil, raisins, and dried fruits.

It seems to me that all the fruit of a ranch, be it much or little, green or dried, that is shipped East, should be packed by the grower. Greed should not allow him to lower the quality. He must remember that much of the complaint we hear from the grower of the low prices or no returns from the commission packer is really only natural, for the commission man must live, and as he receives his commissions before the grower is paid, he naturally will pack closely, and fruit that is really culls will go East at the grower's expense. I never go into the packing-houses in Fresno, but I am surprised at the poor fruit going into the pack. It pays to cull heavily all fruit for Eastern shipment. If we can do nothing else with the culls, they will do for the pigs.

Now, the question has been asked by several women how can I attend to this outside work and manage the housework also. Right there is a grave economic mistake that women make. They think servants are wasteful, and they can not afford them. There are many ranch houses in the San Joaquin Valley where we have eaten dinner and supper, where all were men, no women being within several miles. We have uniformly found good, well-cooked food, served in a clean way. If men can manage this way, why not women? If the ranch is large, the wife should help with the bookkeeping and packing-house work; in other words, be the general inside manager, and by her brains raise the standard of this work.

If we as women can not introduce cleaner and better work into the packing-houses and canneries of this State, there is little encouragement for us to enter upon the hard grind of a business life. If we can improve these conditions, then we have every encouragement, added to the highest of all, that of companionship; for the woman can enter into the cares and hopes of her husband with sympathy, and by this intelligent interest in a common pursuit round out a home life of usefulness and most perfect happiness.

MR. AIKEN. I move you, sir, that the sincere thanks of this Convention be extended to the ladies for their very interesting and effective presentation of the programme, which has been of such great pleasure and benefit and profit to us.

MR. JOHNSTON. I will offer the amendment that the papers be published in the report of these proceedings.

Carried by a rising vote.

REPORT OF THE COMMITTEE ON SAN FRANCISCO AND OTHER COAST MARKETS.

To the State Horticultural Convention:

Your committee, to whom was referred the state of the San Francisco and other coast markets, beg leave to report as follows:

In our opinion the present custom of selling fruit and produce in these markets is wasteful and unnecessarily very expensive, more especially in the following particulars:

First—The grower, at time of shipment, does not know the quantity of competing produce which his shipment will meet—resulting often in seriously overstocking the markets.

Second—He has no assurance of fair treatment at all times.

Third—The charges upon the produce for freight and drayage, owing to shipment in small amounts, is a serious burden in excess of the ten per cent brokerage; and added to this is the careless loss of boxes which should be returned to the shipper.

Fourth—The work of selling is now so complicated and conducted by such a multitude of brokerage firms that it may perhaps be doubted if these men can afford to do the work at much less than the present rate; and to maintain this, which they say is but a living rate, they have determined to coöperate, and are doing so most effectively.

Your committee, therefore, sees no way by which these evils can be remedied except by the coöperation of growers who ship to these coast markets. They alone must control both the distribution and the sale of their products, or suffer the present evils.

To this end we recommend:

First—That the growers form local associations in their several localities for taking charge of the assembling and shipment of produce designed for coast markets, to control as largely as possible the total output at such places.

Second—That these several local associations elect representatives, who shall form a central organization, which shall make such arrangements for shipment and sale as the interests of the producers may require.

We further recommend that a committee of five be appointed by this Convention, to promote the formation of the above-named organizations.

A. R. SPRAGUE.
F. M. RIGHTER.
C. GAINES.

Upon motion, the report was adopted by the Convention.

The Convention then took a recess until 2 o'clock P. M.

AFTERNOON SESSION—THIRD DAY.

THURSDAY, December 5, 1901.

At 2 o'clock the Convention reassembled. President COOPER in the chair.

REPORT OF THE COMMITTEE ON PRESIDENT'S ADDRESS.

The Committee on President's Address submitted the following report:

SAN FRANCISCO, December 5, 1901.

To the State Fruit-Growers' Convention:

GENTLEMEN: We, your committee to whom was referred the annual address of President Cooper, have had the address under consideration, and commend its careful perusal to the fruit-growers of California.

We especially emphasize the suggestions regarding the necessity of securing an appropriation from the next Legislature for securing parasites for insect pests, for revising the present horticultural quarantine laws of the State, and for pure food legislation, and would recommend that these matters be referred to the State Board of Horticulture for action.

President Cooper's reference to the Louisiana Purchase Exposition is timely, and we would offer the following resolutions:

WHEREAS, Preparations are being made for a World's Exposition, to be held in the city of St. Louis in 1903; and

WHEREAS, The preliminary arrangements and financial backing give promise that the said exposition will be one of the greatest and grandest in the world's history; and

WHEREAS, Past experience has demonstrated that under wise, economical, and experienced management participation by California in national and international expositions has proven profitable to the State, affording the most effective means of presenting our great resources and unequaled advantages to the inquiring world; therefore, be it

Resolved, That it is the sense of the fruit-growers of California, in convention assembled in San Francisco, December 5, 1901, that California should be adequately represented at the said St. Louis, or the Louisiana Purchase Exposition, and we earnestly invoke the united aid of the counties and of the State, and of all enterprising men to this end.

We would suggest the appointment of the following committee to carry out this purpose: General N. P. Chipman, Red Bluff, chairman; F. N. Woods, San José; H. Weinstock, Sacramento; A. H. Naftzger, Los Angeles; George P. Hall, San Diego; Frank Williams, Los Angeles; Senator S. C. Smith, Bakersfield; A. R. Briggs, Fresno; James A. Barr, Stockton.

The preservation of forests has received attention at the hands of the President of this association in his address, and we would suggest the adoption of the following resolution:

Resolved, That our members in Congress be requested to present an Act, and labor for its adoption, setting aside from settlement for homes all mountain lands unoccupied in the State of California, and restricting the devastation caused by prospecting for minerals and mining purposes.

In the address of President Cooper reference is made to the reciprocity treaties, and we would offer the following resolution, and ask its adoption by this Convention:

Whereas, The fifty-seventh Congress is now in session at Washington, D. C., and the lawmakers of the land will shortly be called upon to consider and ratify certain reciprocity conventions already entered into between the United States of America and certain foreign countries, and now refer particularly to the convention with France and Jamaica; and

Whereas, The fruit-growers of California and the Pacific Coast firmly believe that the ratification of these conventions will seriously injure the fruit, nut, and wine industry on the Pacific Coast, and that the fruit, nut, and wine industry at large in this country will be placed in jeopardy and seriously impaired by the ratification of the convention for Jamaica, signed July 22, 1899, which proposes a reduction in the present tariff of twenty per cent on citrus fruits; and further, the convention with the French republic, signed July 24, 1899, which proposes a reduction of duty, twenty per cent on nuts, ten per cent on prunes, fifteen per cent on olive oil, and a ten per cent reduction on preserved fruits and vegetables; and

Whereas, Fruit-growers of the Pacific Coast look with alarm upon the unratified conventions, fearing their ratification in the near future, in which event serious uncalled for and unwarranted damage will accrue to the fruit, nut, and wine industry, in which at the present time millions of dollars are invested; now therefore, be it

Resolved, That the fruit-growers of California, in convention assembled, do most respectfully, but earnestly and emphatically, protest against any and all reductions or changes in the existing tariff rates between the United States of America and the Republic of France and the Island of Jamaica, so far as they affect fruits, nuts, olives, olive oil, wine, preserved fruits, and vegetables; and, be it further

Resolved, That our representatives in Congress be, and are, hereby respectfully petitioned to use all honorable means at their command to discourage and prevent the ratification of these conventions as at present outlined; now,

Resolved, That these resolutions be engrossed and the copy forwarded to each member of the Pacific Coast delegation in Congress in Washington, D. C., requesting that this action on the part of the fruit-growers of the State of California in convention assembled on this 5th day of December, 1901, and that the action herein taken, be made known to the Honorable President of these United States and members of the United States Senate and House of Representatives.

We also ask the adoption of the following resolution on the Isthmian Canal:

Resolved, That this State Convention of the California fruit-growers, in session at San Francisco, California, this 5th day of December, 1901, impressed with the utter inability of the transcontinental railroads to handle the enormous and rapid increase in traffic between East and West, urge upon our Senators and Representatives in Congress the pressing need of adopting the recommendations of the Isthmian Canal Commission, and of taking immediate steps for the construction of the canal.

Your committee would also advise the passage of the following:

Resolved, Whereas, the priceless relic of an ancient civilization, known as Cleopatra's Needle, is now disintegrating and going to destruction in Central Park, New York, efforts should be made at once to secure its removal to California, where its safe preservation for the ages to come may impart the pleasure and profit of its contemplation for future generations, and where it may stand a unique and expressive exponent of the most valuable characteristics of the California climate;

Resolved, That the State Board of Horticulture be requested to bring the matter to the attention of the scientific associations and municipal authorities of California cities, as suggested in detail in President Cooper's annual address.

A. H. NAFTZGER, Chairman.

ROOM FOR THE SCIENTIFIC HORTICULTURIST.

ADDRESS BY BENJAMIN IDE WHEELER, PRESIDENT OF THE STATE UNIVERSITY.

The ultra individualism which tolerated and even loved the little rocky farms of New Hampshire and Massachusetts, and spent its toil in building stone walls that served little more purpose than stone heaps, has done its work and lived its day, and a glorious day it was. The old New England farmer depended for his information about what seed to put in, and when to put it in, and what to do with what came up therefrom, chiefly upon the half mythical indications of the Farmers' Almanac. It was a day of small things and narrow outlook. These farms, however, even if they did produce small crops, and apples very gnarly and very sour, availed to produce a type of men that have made themselves felt in the conscience-power of this whole land. I trust the broader, richer farms of this latter day and this more western land will not fail to produce and continue the stock of sturdy, honest, vigorous, upright men. Our schools and universities ought to have something to say about that, and I trust they are making themselves felt; but our purpose here to-day is to consider broadly the interests of the fruit farmers as producers of fruit.

The old New England farmer did not look to the State to help him in choosing his crops or caring for them. Indeed, there was very little the State could have done for him, except to sap his manhood. Everybody knows what the effect of subsidy is and would be under such conditions. There was very little, probably nothing, the State could have done for him. Agriculture and fruit-growing were practiced according to the rule of thumb. Some slender traditions derived from the forefathers—some of the traditions good, some of them bad—served to make up a body of lore by which those fine old farmers conducted themselves as farmers. In these latter days men have come to see that the processes of farming and fruit-growing are just as properly subjects of scientific research as any of the phenomena which swarm about in the universe. The unaided hand of the New England farmer on his little farm could not have maintained an agricultural chemist or botanist; but when the farmers put their heads together and their hands, and interested the National Government in encouraging and aiding study which should take into account the necessities and opportunities of all the farms put together, there rapidly developed in itself a body of scientific knowledge which could be readily adapted to the uses of the men on the farms. This procedure has in nowise transcended the proper scope of the mission of the National Government. It already attends to rivers and harbors, striving, by making the rivers navigable, the harbors safe, to provide a general field and opportunity within which the individual life of the man of business and commerce may be advantageously spent. The Government has as its mission, by providing order, security, and a general open field, to give just such opportunity to individual life. It takes cognizance of interests and materials which exist on a scale too large for individuals to control. What the Government has done in the matter of rivers and harbors, canals, light-houses, etc., sets the standard and affirms the principle for other activities of men outside the range of commerce.

Germany has led the other nations of the world in appreciation of what science can do in promoting the interests of different departments of business industry. Germany's present commercial advance is directly traceable to the scientific activities long cultivated in the obscurity and quiet of the universities. Not until a solid foundation was laid in genuine scientific method and result was the application of the results attempted. We used to think Germany a land of idealists and romancers and bookworms; but Germany developed, through its men of ideas and men of patient toil at books and in laboratories, a standard of scientific work which made possible, when these sciences came to be applied to the plain things of life, a tremendous forward push in manufacture, forestry, agriculture, and almost every form of practical art, which had distanced almost with a spurt every near competitor. England has been losing in the race of recent years, not from lack of capital, not from lack of commercial opportunity, not from lack of honest and industrious men, but almost exclusively from over-confidence in amateurism. England has retained the services of amateurs in its army, in its governmental positions, in its manufacturing interests, and in the various departments of the arts to such an extent that it now on the sudden wakes up to find the age has sped away from it. Germany has been in the habit of using inferior materials in manufacture, and has in general catered to an inferior market. As long as it turned its attention chiefly toward Asia Minor, South America, the East Indies, England felt little solicitude; but suddenly it has burst over the barriers and its products are entering the best markets. The advantage which Germany has in this last stage of the race is traceable directly to the employment of expert workmanship in the arts of specialists, in the specialized lines of industry, and to the use, frankly and fully, of the best scientific results attainable for application to any work that is to be done.

We have been reluctantly following in the wake of Germany in this matter of recognizing expert service and scientific information. The American, in his fine admiration for all-roundness and gumption, has been all too unwilling to vacate the throne of all wisdom concerning all subjects. The expert, whether it be in business matters, in political matters, or in matters that belong properly in the domain of science, has been too slowly given a hearing. The average American thinks he is competent to hold any office to which the people may elect him, and to enter at a moment's notice upon the completest exercise of its functions, whether that office be surveyor of highways, inspector of milk, member of the legislature, or ambassador to the Court of St. James. There is a good side to this, and I sincerely hope and pray that gumption may never cease to be numbered among American virtues. If, however, we are to take our place as competitors in the modern industrial race, we have got to recognize the expert and the scientist. California has great interests at stake. Thirty to forty million dollars a year is the value of its fruit crop. It will not be many years before enlarged markets, vastly improved methods and opportunities of transportation, and fuller application of scientific knowledge to practical fruit-growing will make this crop worth two hundred millions in place of thirty. What science can do for horticulture it has only just begun to do. We still rely too much upon the old *laissez faire* methods of natural growth. It is so easy to settle down into the comforts of fatalism and urge that things will work themselves rightly if we only give them a chance. Let the rains descend, and the winds blow, and the sun shine as God intended they should, and intends they shall, and things will grow of themselves; but there is a higher philosophy than that of evolution which works in the affairs of men—it is the philosophy of will, the intervention of the energized and enlightened will of man whereby he shares divinity with the gods. A Burbank who bends nature to his will is the representative man according to this higher philosophy. It is the business of man to subjugate nature, to shape it to his purposes, and to bend it hither and thither. But what we will control we must first know, and the first task of the scientist who through his studies will lend aid to those who gather bounty from nature, is to discover the secrets of nature, her secret ways of living, her secret habits of feeding, her secret methods of growth, and then he must turn these prejudices and preferences of nature to his own uses and purposes, just as the wise and far-seeing always play with the ignorant and short-sighted, and by a law written in the face of the universe must always do.

While I am urging a very great extension of confidence in scientific work and advice and leadership I am not overlooking the abundant good which science has already rendered to the interests we here represent, especially to those interests as represented in California. The problems confronting the horticulturist here are evidently in some measure distinct from those in the eastern portion of the country. We have recognized that the climate and the soil require special study, and compel us to special processes. The investigation of our soils on both chemical and physical lines which has been conducted for a series of years, chiefly under the leadership of Director Hilgard, have brought results the value of which it is not easy to measure. Scientific investigation has been utilized to show on the basis of rugged scientific tests that California fruits are larger, handsomer, sweeter, and endowed with better keeping qualities than fruits grown elsewhere. All these are on record in the tables of chemical and physical analyses, and are raised beyond dispute. Science has done much in directing men toward the proper use of different soils. Some are better than others, some are suited for fruit-growing, some are unsuited. Many a man has been spared disappointment and loss by being warned that a certain soil was not suited for the trees he proposed to plant upon it, when, without the determinations which chemistry alone permits, he would have been unable to protect himself through observation of any surface appearances. The investigation of climate and water on a scientific basis has done much, and will, when carried further, do much more in determining what particular localities are suited to what class of products. It is furthermore only a few years since the weather observations attained sufficient scientific accuracy to be worthy the heeding of fruit-growers. To-day I venture to say no wise man engaged in such pursuits fails to closely watch the weather prognostications, particularly when frost is in the air. We are but in the beginning of these things. It is within the memory of most of us here present that these attempts to bring large ranges of facts together and combine them by the observation of laws into what may be called results have had their existence, and surely we can not expect that this entirely new method of procedure in human affairs should have reached its completeness within a score of years. We are only at the beginning, we stand merely in the doorway. What science can do for human life, for industry has not yet been even dreamed of.

The cultivation of single lines of fruits and vegetables upon extended areas has given the opportunity for the development of all sorts of pests. Sin seems to abound wherever virtue is, and I have heard that the devil is never more active than when the cause of good is thriving. At any rate that seems to be the case with all forms of insect pests. The Colorado potato-bug used to have a hard time getting a living when he was obliged to tramp long distances from one potato vine to another; but when people planted the potato vines conveniently for him in rows, and by the acre, he throve, increased, and multiplied, like the children of Israel in the Promised Land. The bounty of nature seems always to be attended with troubles and dangers like these. Eternal vigilance is the price of safety. I think California horticulturists have all of them more or less cause to be thankful already to science for what it has done in helping them fight one pest or another. Only this past week we received word from Newcastle of the dangerous development of the peach moth in that vicinity. It is a new trouble and will require special investigation. The University has employed a man, Mr. Warren T. Clarke, who will be specially delegated to that task, and will spend a considerable portion of the next few months, if not the whole time of the next six months, in the work of finding out what is to be done, and, if possible, doing it.

I hear that the Eastern manufacturers of Paris green stand in high horror of those California scientists who have made it impossible for them to palm off their fine adulterations upon the California trade. They are now obliged to prepare, we hear, a special Paris green particularly for the California market. We owe to science, also, something in the discovery of beneficial insects. It was only through scientific study that there could have been found out what was the lack in our fig culture, and the introduction of an insect to distribute the fructifying pollen to the blossoms of the figs represented a service of surpassing value to this State. Chemistry has removed many of the difficulties in the canning and drying of fruits through explaining the sources of troubles, and providing remedies therefor. The problem of pickling the ripe olive has been advanced to solution through scientific investigation of causes which produced troubles therein. I was not, however, called in here to enumerate the things that have been done. There are few, I suppose, that know less about them than I do. What I am here for is to express to you my strongest and most enthusiastic confidence in the work that is now doing through the organized labors of the State Board of Horticulture and the Department of Agriculture in the State University, to uphold the hands of the fruit-growers of this State, and to advance and strengthen the industry which they represent.

SELECTION, NATURAL AND ARTIFICIAL.

David Starr Jordan, President of Stanford University, delivered a very instructive and entertaining address on the application of natural laws to horticulture, showing, by numerous illustrations, how animals and birds adapted themselves to their environment and changed their characters to suit their changed condition, and that by understanding and applying this natural law of evolution the horticulturist had been enabled to produce new varieties and improve old ones until we had attained our present high standard.

He prefaced his remarks with the suggestion that one of the most important functions of the State might be that of scientific research, investigating the nature of matters in which the attainment of the scientific knowledge absolutely necessary to success would be beyond the reach of the ordinary citizen, or even corporation. He gave as an illustration of this the inquiry into the nature of the cottony-cushion scale imported from Australia to California, which became at once so destructive to the fruit-growing interests. The investigation carried on by the State showed that this scale in its native country is devoured by a ladybug, the *Vedalia*, and this *Vedalia*, brought to California, has almost exterminated the threatening pest. Similar investigations seem likely to disclose the real nature and the natural enemies of the so-called San José scale, and Government investigations of a like nature, and legal protection, may be necessary to save the oranges of the State from the devouring grub so common in Mexico, and to save the English walnut from a similar pest in Europe. If these pests should become established in the State, as seems probable, it is beyond the power of an individual to fight them, and they can only be fought through knowledge.

The same rule applies to scientific investigation in many fields. Aristotle once declared it a function of government to do whatever is of common interest, and whatever it can perform better than individual enterprise is able to do.

Dr. Jordan referred to the process of artificial selection as used in the development of varieties of fruit or of breeds of animals. He detailed briefly the theory underlying hybridization and selection, as practiced by Mr. Luther Burbank, the great master in that art, and showed something of what can be done along the lines in which individuals vary.

He then showed charts illustrating the singing birds of the Hawaiian Islands, the thirty species or more being essentially alike in bodily structure, but differing in a most extraordinary degree in the form of the bill. It can be shown with great probability that these birds have all sprung from one stock and that that stock is some one of the numerous species of honey-creeper found in Central America. The honey-creeper has a slender, slightly curved bill, and birds of that type are still extant on the oldest of the Hawaiian Islands, Kauai. Then it can be shown, in accordance with the demands made by different substances on which birds feed, how this bill has become longer and longer, more curved, fitted for sucking honey from flowers, and finally changed into an extremely long, bow-shaped bill, suitable for probing into the depths of the leaf-cup of the Ieie-vine, and into the thick masses of lichen, in both of which places numerous insects are found. In still other birds the upper mandible has become exceedingly long and flexible, while the lower is cut off short. These birds pound on a tree, like a woodpecker, with the lower half of the bill and scale off the bark or knots, while with the upper half they draw out insects. The upper bill is used mainly as a probe. Still others have the bill short and thick; and others, exceedingly strong like that of a grosbeak, and capable of cracking nuts. Still others have the tips crossed like those of the cross-bill. Other highly modified forms have a bill as heavy and as capable of cracking nuts or tearing fruits as the bill of a parrot. These are adapted to the tough fruit of the Ieie-vine. Of each of these styles of bill there are numerous species, each island having some. The exceeding uniformity of the birds in other respects shows that they are variations of one common stock adapted to special conditions of food or special need in life. The relations of these birds have been worked out by Mr. Henry W. Henshaw, a distinguished naturalist living at Hilo.

MR. AIKEN. I move you, sir, that the sincere thanks of this Convention be extended to Professors Wheeler and Jordan for their able and interesting presentation of these subjects to the fruit-growers, and for the honor of their presence on this occasion.

Motion carried by a rising vote.

REPORT OF THE COMMITTEE ON TRANSPORTATION.

MR. R. D. STEPHENS, chairman of the Committee on Transportation, submitted the following report:

Mr. President, Ladies and Gentlemen:

Your Committee on Transportation beg leave to make the following report:

There can be no doubt that the improved service given to green deciduous fruit shipments this year by the Southern Pacific Company, and its connections, was of great benefit to the fruit-growers of California. The time occupied in transit being materially reduced, greatly aided distribution, and, by doing so, increased consumption. This has resulted in restoring confidence in the minds of the growers, who are again beginning to believe that fruit-growing in California, and upon a much larger scale than ever before, can be made to pay a fair profit upon the labor and capital invested in its production; *provided*, that the time-schedule agreed upon between the railroads and the fruit-growers, in May last,* *be put into full force and effect by the railroads*, the only party to the agreement that has the power to do so, and the elimination from the business of refrigerator cars that are owned and controlled by private interests.

We believe the private ownership and control of refrigerator cars used for shipment of California fruit to be inimical to the interests of the fruit-growers and shippers, as affording an opportunity for discrimination and favoritism.

All cars and other transportation facilities should be owned and controlled in every particular by the railroads, and all shippers should have equal facilities and be upon equal terms.

We, therefore, in this public way, record our earnest protest against the renewal or extension of existing contracts with the refrigerator lines now engaged in this traffic, or the making of any similar contracts with any parties whatsoever.

We make further objection to the private ownership and control of these refrigerator cars, as having the effect to maintain what we consider *excessive refrigeration rates.*

We feel that the Southern Pacific Company, and the other roads that are engaged in carrying California fruits, are entitled to the thanks of the fruit-growers of the State, for their efforts to give an improved and adequate service in the transportation of our fruit, and we therefore suggest that a vote of thanks be tendered them by this Convention for what they have already done in the way of an improved service, *thus showing that the fruit-growers of California realize and fully appreciate what has been done in their interests.*

Respectfully submitted.

R. D. STEPHENS, Chairman.

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*See copy of Wm. Sproule's letter of May 21, 1901, in Appendix.

SUBSEQUENT ACTION BY COMMITTEE ON TRANSPORTATION.

Statement of Facts from the Fruit-Growers to the Transportation Companies.

The Committee on Transportation beg leave to submit the following in support of the action taken by the growers in convention assembled:

The above shows the action taken by the fruit-growers of the State at their annual convention held in San Francisco December 3–6, 1901.

They are irrevocably opposed to the private ownership and control of the cars in which their products are shipped to Eastern markets.

They feel that the time has come when they should *be relieved from paying heavy tribute to this, the worst of all monopolies.*

There are no insect pests or blights so damaging to the fruit interest of California *as this control.*

Its power is so great as to subordinate all other interests, and when combined with the marketing, is absolute.

There is no power that can prevent such combination so long as *private cars have the monopoly of carrying our fruit, with a tariff that brings in such an enormous profit as does the present tariff* for refrigeration, for the reason that the large fruit companies are corporations, and there is no law through which the *transfer and control of the stock of such corporations can be prevented.*

This fact is mentioned for the reason that the railroad companies claim to be opposed to a combination of such a character, and we desire to show that the only way to prevent it is, not to enter into a contract with the Armour Company, or any other car line, for the reason that it would be easy for the car line with which the contract is made to soon gain control of a fruit marketing company by having a majority of the stock transferred to it, *or have it held in trust subject to its wishes.*

All the growers ask is to be put on equal terms with the refrigerator companies.

They do not ask for a greater per cent of profit upon the capital they have invested than that received by the car lines for the capital they have invested.

Refrigeration has been the bane of the fruit-growers of California.

It has done more to retard the progress and prosperity of this State than all other things combined, for the reason that it possesses the power to almost wholly, if not quite, control the marketing of its fruit products.

While it has been doing this for California, it has been *utilized to build up strong and powerful competition in Oregon and Washington.*

We are credibly informed that the charges for refrigeration from these States to the Atlantic seaboard are but from $10 to $17 per car. In some instances a higher rate is charged, but it is claimed that in such cases a corresponding reduction is made in the way of a rebate.

This explains why the fruit from Oregon and Washington can be sold in Eastern markets, *in competition with California fruit, at a much lower price, and yet bring a good profit to the grower.*

This has resulted in not only rapidly increasing and multiplying fruit shipments from Oregon and Washington, but also *in building up competition that otherwise never could have existed.*

Now that we have to meet this competition, all we ask is to be put on an equality with the growers of Oregon and Washington.

This can be done by the adoption of any of the following remedies:

First—*The ownership and control of refrigerator cars by the railroads themselves.*

Second—The granting of the right by the railroads to all refrigerator car lines of equal rights and privileges, to enter into competition for the business, with a reduction in charges to an amount that will prohibit the giving of rebates.

Under no circumstances should a contract be made with any company for a longer period than one year, and that, too, with *a distinct understanding that a very material reduction should be made in the rates now prevailing.*

The growers of California should be placed upon an equal footing with the growers of Oregon and Washington.

TIME-SCHEDULE.

In regard to the time occupied in the transportation and delivery of our fruit at Eastern destinations, *we reiterate all that we said in our memorial upon this subject* for the season just past, and earnestly pray that the time agreed upon last May between the growers and the railroad companies—*six days to Chicago and similar points, and nine days to New York and similar points*—be put into full force for the coming season—1902.

While California has no equal as a fruit-producing country, yet its growers can not successfully compete with the growers of other localities who are less favorably circumstanced, particularly those of Washington and Oregon, so long as private refrigerator car companies are permitted to control the marketing of its products as they have done in the past and will continue to do in the future if allowed to continue their present extortionate rates for refrigeration from California *as compared with the rates from Oregon and Washington.*

This we hold to be unjust discrimination against our growers, and therefore an impediment to the progress of the State.

While refrigeration has for years past held green fruit shipments from California in *statu quo*, it has been the *incentive for orchard planting in Oregon and Washington*, where the fruit area has increased several hundred per cent in the same period.

In conclusion we will say that, as a matter of fact, charges for refrigeration should be such as to cover cost only. *Then rebates, the key to control, would be made impossible.*

Profit for transportation should be in the freight charges alone, as it is in the charges for other commodities that are shipped in box cars. Then there would be a reasonable profit made in fruit-growing in California, which would materially add to its prosperity.

MINIMUM CARLOAD WEIGHT.

We wish to especially mention the fact that the growers fully appreciate the action of the railroads in lowering the minimum carload weight from 26,000 to 24,000 pounds. There is no doubt that much good came from this action.

The Fruit-Growers' Committee on Transportation most respectfully submit the foregoing requests for relief, with the hope and prayer that you give them careful and favorable consideration.

Respectfully yours,

R. D. STEPHENS, Chairman.
A. H. NAFTZGER, Los Angeles.
A. N. JUDD, Watsonville.
ALEXANDER GORDON, Fresno.

SACRAMENTO, December 23, 1901.

[For correspondence between Committee on Transportation and railroad managers, see Appendix.]

MR. STEPHENS. Now, Mr. Chairman, before I have anything to say upon this I will state that Mr. William Sproule was extended an invitation to be present here to-day in person, to give us the reasons why the schedule-time promised was not carried out during the past season. I now move that Mr. Sproule be allowed to address the Convention at this time.

Motion carried.

REMARKS BY WILLIAM SPROULE.

MR. SPROULE. Mr. Chairman, and Gentlemen of the Convention: When I was asked to come here this afternoon I did not know that I was being asked to address you; instead of that I came here to be instructed by you, for no man can handle his side of the question intelligently unless he has a fair knowledge of the position of the other side. I understand, however, that all I am expected to do at this time is to be apologetical in my remarks as pertaining to last season's service. That is an attitude I don't want to be in; on the contrary, I would confirm what I said in my letter to Mr. Stephens, to the effect that I believe the carriers gave this past season a service that is the best that has ever been given in the fruit business. You will remember that we did some years ago experiment with limited trains on a 120-hour schedule from Sacramento to Chicago. We ran a few in ventilated cars, and thought that we did very well, and the growers thought so to, and this year we have done that, not with a few, but with a great many trains of refrigerator cars. The service on the line between Sacramento and Ogden has been maintained fully up to our expectations. The service on the line east of Ogden has been greatly improved, and the improvements could only be brought about by harping on the same string. We carried out the best service we possibly could, but the fruit was at times diverted to a line that was not giving good service. We told them that they could not get any more of the business until they gave the service. The strikes caused us a great deal of inconvenience. No one knew that the strikes were to come on, or that they would last the way they did. We ordered one hundred and three engines early in January, and the delivery was to be made in time to take care of the fruit business; they were not all freight engines, however. The builders turned out those locomotives as fast as they could, but not fast enough to meet the requirements. The foundation of the locomotive is the steel in it, and you could not get the steel when all the steel manufacturers were on a strike. You see those strikes were of much concern to us. In matters economic we are a united country, industrially as well as politically. The transportation of our freight was delayed, and it was only by persistently making the effort to secure, as far as possible, the segregation of the California fruit business from the general freight business, and treating it as a preferred and perishable freight, that results have been secured as you have found them to have been carried out. The prospects for the coming season I believe to be improved; we are now receiving locomotives more satisfactory in their deliveries than anything that occurred up to within the past sixty days. I have recently been in correspondence with every railroad to which we deliver oranges, with respect to their time and service. One of our communications says: "We have twenty-five Mogul engines just received from the shops that we are prepared to put on our western division to take care of your business." The carriers are particularly interested in California business, and they realize that the success of their business depends largely upon the prosperity of you growers, and they are willing to do all in their power to assist you. There is no kind of business in this State, or in any other country in the world, that affords such a variety of avenues of prosperity as does the fruit industry of California, and we are very glad indeed when we are able to rejoice with you in your having had a prosperous season, and to us it is a source of very serious regret when the season has not been prosperous. All I can say is that this coming season we shall aim to do our share toward giving you a service that will enable you to say, at the close of the season, if it was not, perchance, as profitable as you had hoped, that it was not the fault of the carriers.

MR. STEPHENS. I move that a vote of thanks be extended to Mr. Sproule for his attendance here to-day, and I wish to say that when you see Mr. Sproule you see a friend of the fruit-growers of California. I not only know he is a fruit-grower himself, but I know he has spent much time in securing from Eastern lines promises that have been of value to us.

Motion carried.

REPORT OF THE COMMITTEE ON THE OLIVE PROSPECT.

By GENERAL N. P. CHIPMAN, of Red Bluff.

GEN. N. P. CHIPMAN. Mr. President, Ladies and Gentlemen: I want to say with regard to this report, that when the subject came into hand for preparation there were two views to be taken of the question, or rather of the nature of the report. One was simply to make a summary of the findings of fact or the results without giving you the evidence. In the other form of report we embraced the evidence. You have had numerous communications from very high sources of results of observations of high character and of great intelligence, but they were merely the results and not the evidence; so it was concluded that you should have the evidence in this report. For the purpose of obtaining it I addressed, or caused to be addressed through the officers of the State Board of Trade, communications to a large number of olive-growers and manufacturers of olive oil and pickled olives, and this report is the result of the responses to those inquiries.

(In the preparation of this report letters were addressed to all the principal olive-growers of the State, and replies received from most of them. These replies are given in full in the report, but are too voluminous to reproduce here. From them, however, General Chipman makes the following summing up:)

CONCLUSIONS.—Having presented the evidence in the case, we are now prepared for deductions and a verdict. I have given you the testimony of about fifty witnesses, widely scattered over the State, nearly all of them growers, and most of them manufacturers of oil or pickles or of both. The time embraced reaches back a considerable period of years, with experiences and observations brought down to date. Upon some points there is a conflict in the evidence, on others an entire agreement, but the evidence in its entirety largely preponderates in favor of the industry.

When I began the investigation my mind was unfavorably prejudiced; my own experience and observations had raised a most serious doubt as to whether I should dig up my forty-acre orchard of Picholines, or graft them to some other variety. This investigation has determined the question, and I shall graft and not dig up the trees. Let us briefly analyze the evidence and put the results in concrete form:

First—*The Olive Tree:* It may be and is successfully grown in nearly every county from San Diego to Shasta, below 2,000 feet elevation, and even at that, or greater, elevations I believe orchards are thriving. It grows equally well in all kinds of soil; the yield and quality of the fruit depend on the fertility and adaptability of the soil, as must be obvious. The tree is not subject to nearly so many or so serious enemies, insects or diseases, as the trees of the old world. The chief enemy, the black scale, is easily overcome, and this insect is not particularly troublesome in the dry, hot atmosphere of the interior. So far as we know, the olive knot, apparently the most dangerous enemy now confronting us, is found only on foreign varieties, and has never been found on the Mission; and almost the universal opinion is that the Mission is the best variety for all purposes, irrespective of its probable immunity from tuberculosis. The statistics I have given you show that the yield per acre and per cent of oil in the olive are greater here than in Europe. Our methods of orchard culture and of oil manufacture are better and will bring the tree into bearing sooner than is done in Europe.

Second—*The Oil:* There is entire agreement that the chief impediment to profitable oil-making lies in the fact that adulterated oils are sold with labels falsely designating them as pure olive oil. I have shown you that the producers abroad are contending with the same unfair and fraudulent competition. I have shown you that in this State the law gives us ample protection, and that it is our fault that here, at least, we have not extirpated cottonseed oil and adulterated compounds put on the market as olive oil. How can we consistently ask other States, or Congress, to enact restrictive legislation similar to our own when we neglect or refuse to enforce the laws we have for our protection?

Third—*Pickled Olives:* I think it is no unwarranted deduction from the evidence that there is a wide market for pickled olives, especially ripe pickled olives, at remunerative prices to the grower and manufacturer. Here, again, the failures are traceable to ourselves. Is it too much to say that if A and B can pay, and are paying, good prices for olives and pickling them and selling them at a profit, others may not do so? A business should be judged by its intelligent successes, not by its ignorant failures. There is no reason for the existing conditions I have shown, that in Los Angeles the manufacturer is paying but $30 to $40 a ton for olives for all purposes, while at Oroville he is paying $40 for oil olives, and $75 for pickling olives. The Oroville manufacturer assures me that he can do well and pay these prices. There is something out of joint at Los Angeles. I am not surprised that the growers have formed an association for self-protection. Pickling both green and ripe olives, and, indeed, the manufacture of oil, is an art. There is also connected with that branch of the industry the mercantile faculty of finding a market. Is it to be supposed that each individual grower in the State, without previous experience and without the knowledge of how best to follow his fruit in all its stages, from the tree to the consumer in other States, can, single-handed, be entirely successful? It is quite probable that we may have to come to some such source as has been suggested by some of my correspondents, and establish in the several olive districts large plants to handle the fruit, either as an independent business or by coöperation of the grower. Nevertheless, I have given you evidence that at least two women are growing olives and pickling them and selling them with satisfactory results; and some men are doing equally well. The evidence is that in pickling olives the failures are attributable to ourselves, as usual. We have not all of us learned the art; we can not give the ripe pickled olive the keeping quality; some of us glut the home market with rubbish, and few of us have given the subject the careful and thoughtful consideration it demands. We have gone headlong into a business we knew nothing about, and we have expected that by some sort of inspiration our ignorance would be superseded by wisdom; and, now, we are seeking to shift all the responsibility for our individual failures on the American people, because they fail to give us rush orders for our oil and pickles. Neither the gods, nor the American people, are looking around to help those who will not help themselves.

In 1897 we imported 942,598 gallons of so-called olive oil. Notwithstanding Mr. Cooper's estimate of the possible output of all the trees now planted, it will be a long time before we can produce this quantity of oil, and when we do, if it is of good quality and is kept pure, we have the world for a market. According to Mr. Cooper's estimate, which I think excessive, allowing 100 trees to the acre, we have 25,000 acres in olives. I have shown you that in two districts of France there are 150,000 acres. In Tuscany alone there are 270,000 acres, and many times this acreage in other parts of Italy, where the total output of oil is stated to reach 90,000,000 gallons. When you consider the production of Spain and other olive countries, and that less than a million gallons find their way to the United States, it seems to me that with reasonable hope of ultimate success we can continue to present the olive industry as one of the many attractions of California.

I can not close this report without expressing my grateful acknowledgment to Mr. George A. Dennison, Acting Manager of the State Board of Trade, without whose intelligence and assistance in gathering the facts together I would not have been able to lay them before you. Acknowledgments are also due to Mr. Victor J. La Motte, Assistant at the State Board of Trade, for transcribing and otherwise rendering efficient aid in the work.

Upon motion of Mr. Sprague, the report was placed on file, and the State Board of Trade requested to print the same.

EVILS OF THE PRESENT METHODS OF SELLING THE OLIVE.

By C. A. WASHBURN, of Los Angeles.

It is safe to assume that most of us here in the olive industry have passed various vicissitudes and difficulties unnumbered, through the long years necessary to bring a commercial commodity into bearing. We have studied in the nursery varieties best adapted to our soil; we have watched with eagerness the result as each succeeding season passes, of drought or excessive moisture, too little or too much fertilizing, cross-pollination, and irrigation or not, and always the scale, and methods for its destruction.

The subjects here outlined have been scientifically and ably discussed before you, and practical results of theories advanced permit the assertion that anxiety can largely give way to the application of good judgment, to insure to us an article of commerce that the American palate is demanding more each year, and with the most prolific production California is unable to supply but a small proportion.

The uncertainties of a crop having diminished to a minimum, and the demand known to exist for a merchantable quality of it, bring us to a point when discussion of the evils of present methods of preparing and selling the fruit, and the remedies necessary, is the last and at present of the utmost importance.

The policy adopted at the beginning of this young industry will determine what degree of prosperity the grower is to enjoy in the future.

In law, an accessory to a crime can not waive responsibility; neither can the grower lessen his responsibility to this industry by supplying the trade with an inferior commodity, whether it be his individual production, or that of an incompetent mill man, whom he recognizes as equally incapable.

Experience has shown beyond doubt that the Eastern jobbers have lost confidence in all our processes of pickling, and well they may have, for each grower, or mill-owner, has an individual method, with results, in most cases, equally disastrous to the purchaser, when one can be found.

The question of proper pickling has not been satisfactorily solved by all, and will not be until *the correct* method is uniformly adopted; and until such time no extended Eastern market will be permanently open to us.

A secondary prejudice of the Eastern jobber is the instability of price—as a natural consequence when practically each manufacturer seeks a buyer at such figures as his circumstances dictate. An absurdly ruinous and exceedingly profligate expense to an otherwise profitable industry. Bear in mind that a merchantable article must of necessity be a satisfactorily finished product, and let us not deceive ourselves by thinking a solution will apply itself to existing conditions, without coöperation, both in preparing and in selling this product. This branch of the industry is seriously threatened, and each day's delay in applying a remedy makes the problem more difficult of a successful solution.

Trade responds more liberally in the oil branch of the industry, because of a more uniform quality; but the average grower is in this handicapped to such an extent by his dependence upon the public mill, that any possibility of a market above cost of production is problematical, and largely dependent upon the generosity of the mill man.

The effect is the same to the grower, whether each manufactures his own oil and sells it, as before referred to, or sells the green fruit direct to the mill and burdens the industry with a manufacturer's profit. In 1900, the public mill in Los Angeles, paying an average price of $50 per ton, for fruit delivered, was selling oil in bulk at $2.25 per gallon. In 1901, the mill paying $35 for the fruit, is quoting oil at $1.85, a depreciation of nearly eighteen per cent in the manufactured product, and thirty per cent in the green fruit; in other words, a profit of twelve per cent more to the mill in 1901 than in 1900, which, as a reserve, is sufficient to meet any possible competition this year from the grower who manufactures.

The depreciation of the raw material here is not justified, and a reason for which no condition exists, except an absence of organization and the non-application of business principles.

As a remedy, I would suggest a plan that guarantees to each grower, large or small, equal advantages of an enlarged trade connection at a minimum cost. More particularly I would recommend a subdivision of all territory into districts, the members of each district buying, or controlling, a suitable mill located at a common center, and by a directorate collected by them, controlling the management and expenses of that mill, and each paying such a price per ton for treating, as the directors may determine. The product of each mill to be under the control of an association manager, who shall sell the output to the best advantage, and report, less commissions, to the district mill, which in turn will settle with its members. Aside from absolute control in marketing the product, and suggestions from time to time as to the output, based upon trade demands, the association managers shall have no voice in district management. The manager shall be appointed by a board of directors composed of representatives from the different districts. This board of directors shall fix commissions, and shall have general direction, through the manager, of all sales. At the termination of the fiscal year, the association profits, less expenses, shall be distributed to the district mills, in such proportion as each mill contributes in value to the total sales of the association; and each district member, in turn, to receive from his mill his proportion, in the ratio that his product bears to the entire mill output. I have suggested here merely a basis for economical, effective, and coöperative management, which can be applied with little detail, and will enable us to get at the root of the evils of this industry, summarized, viz:

First—Absence of a good, uniform system in preparing our fruit;

Second—The excessive expense of selling individually the finished product, when manufactured by the grower, and the consequent instability of prices; or, the absolute subjection to, and dependence on, the dictates of a public mill;

Third—Absence of organization, whereby the grower is denied that close touch with the trade necessary to success.

The Remedy—Organized coöperation.

For the past three years the trade has paid the importer in Los Angeles from $2.10 to $2.50 per gallon in cans (depending on size of package) for what is claimed a pure quality of Italian oil. By the tariff act of 1897, an import tax of 50 cents per gallon was imposed. The tariff and the importer's price are the same to-day; but within the time mentioned the local product has declined from $3.50 to $1.85 per gallon, and always to meet foreign competition—an argument of the jobber that has not yet lost its effect upon the unsuspecting and defenseless grower.

It is my purpose, Mr. Chairman, to lay on the altar of this Convention the evils of our particular section, with a word of warning, if any there are who have not suffered from similar indiscretions, and to submit in all earnestness this question: Why is it, when the production of olives in America is practically confined to this State, with a protective tariff, and the law of supply and demand so pronounced in our favor, that we can not, by applying business methods, get the benefits we are now sacrificing, but to which we are so justly entitled?

PROF. HILGARD. I will say one word only in regard to the matter of olives. The Experiment Station of the California University has found that we frequently get samples of oils sent to us with complaints that they do not taste right; and it has happened that those samples are the pure oil, and that the oil they want is the adulterated oil. I am sorry to say that I have had on my table pure oil and adulterated oil at the same time, and the adulterated oil suited best. Regarding the pickled olive: A bulletin is now being printed on the subject, and it will be distributed. We have tried the methods of using strong and weak lye in treating the olive. Strong lye has proven not to be good, as it is impossible to get a keeping olive with strong lye. If you insist on shortening time by using strong lye, the olives will not keep. If the olives are cured slowly by repeating the use of weak lye, and especially if the additional salt is put in after the first lye is taken off, you will get better results. There can be no rules given about the quantities to use, because the olive that is irrigated differs from the olive that is grown without irrigation. The strength of the solution has got to be left to the pickler. With the weaker solution and using it oftener, we have found that at the end of thirty-two months the olives have been as good as they were the first day. You will get all of this information from the bulletin we are going to issue.

FROST, AND HOW BEST TO OVERCOME DAMAGE BY IT.

By PROFESSOR ALEXANDER G. McADIE, of San Francisco,
Forecast Official of the U. S. Weather Bureau.

PROFESSOR McADIE. Before taking up this paper upon the method of frost-fighting, I would like to say that I have visited a great many fruit ranches from Shasta to San Diego, and have heard a great deal of testimony along this line, during the past four or five years. Some of that testimony has been of this character: "Yes, I have tried smudging, and tried it well, too; and all that I ever got out of it was a heavy cold." I believe that under the weather conditions of the last ten years, we can carry our citrus and deciduous fruits through great deal colder periods with a loss of probably not more than five per cent.

With the possible exception of the loss occasioned by insect pests, there is probably no one cause of loss so seriously affecting crops in

California as frosts. Notwithstanding statements sometimes published, that certain areas are in the so-called frostless belt, there does not appear good reason for believing that any portion of the State may not be visited by frost.

The losses to the fruit crop, both citrus and deciduous, through frost, have been so large that special attention has been given to methods of protecting orchards; and these methods are discussed in detail in the following pages. With citrus fruits the frosts of December, January, and February are to be guarded against; the fruit being ripe and ready for shipment. With deciduous fruits the late spring frosts do the damage. Almonds, apricots, grapes, peaches, and prunes are hurt while in bud or while the fruit is just setting, by the frosts of March and April. The damage depends in all probability as much upon the condition of the tree as upon the degree and duration of the cold. For example, a sharp frost during the first or second week of April sometimes does less damage if the trees are fairly past the blossoming period than the same frosts would have caused occurring about the middle of March.

Attention is invited to the excellent table prepared by Mr. Samuel H. Gerrish of Sacramento, giving the dates of first and last light and killing frosts; also the dates of blooming fruit trees in Sacramento, from 1869 to 1901.

The protection of gardens, both vegetable and flower, is also important. The particular frosts affecting gardens are the frosts of February, March, and April, and it is pointed out in the succeeding pages that the same general principles used to protect orchards should be followed in the protection of gardens. A clear, still night, following thirty-six or forty-eight hours of boisterous north wind, is likely to be followed by frost, particularly if the movement of the air in the given locality has been such as to cause a settling of cold, relatively dry air strata in the hollows or depressions of the land. The formation of frost is essentially a problem in air drainage, and if by any means we can prevent streaks, pools, or basins of stagnant, cold dry air, we can largely prevent frost. Frost, as commonly understood, is the water vapor of the air deposited upon the plant at a temperature below 32°. The damage to plant life is, however, really caused by the falling or rising temperature, and not by the deposit of ice. The water vapor plays the part of an index only. Indeed, the action of the water is preventive. Dry air at a temperature of 32° weighs 563 grains per cubic foot. Water vapor at 32° weighs 2.1 grains per cubic foot at a saturation of 100 per cent. Air at a temperature of 25° F. weighs 572 grains per cubic foot. Given a little time, therefore, on a still, clear night, the loss of heat by radiation from the plant surfaces and the ground will bring about a settling of the colder air to the bottom. The ground will be covered with frost, while thermometers six feet above the ground will record 34° or 35° F. Vegetables and flowers, therefore, unless grown upon sloping or terraced ground, are at a decided disadvantage compared with tree fruit in the matter of frosts.

NATURE OF FROST.—It can not be emphasized too clearly that it is the low temperature and not the solidification of the water which does the damage. If there be but little vapor in the air there will be but a light frost apparent, and yet the temperature may be so low as to cause great injury. The so-called hard, dry frost, also called black frost, does, as is well known, even more injury than heavy frosts. Water vapor at 25° completely saturated weighs 1.6 grains per cubic foot. In the fall from 32° to 25° nearly half a grain per cubic foot, if the saturation were 100 per cent, would be condensed, appearing in visible form as frost flakes. A certain amount of heat was given off in the transformation of this visible water vapor into ice, and an exactly equal amount of heat (known as the latent heat of vaporization) will be in turn required to change this frost flake back into vapor. We give special attention to this point, because it would appear theoretically that the secret of successful protection of garden truck and delicate flowers will be found in this action of water, both in setting free heat at the time when the temperature is falling, and on the other hand in using up heat and thus acting as a retard or brake when the temperature begins to rise quickly.

It is now quite generally believed that as much injury results from the sudden warming up of the dormant and thoroughly chilled flower, fruit, or vegetable as from the chilling itself. In the work of protecting fruits from frost it has been found very necessary to interpose some screen early in the morning between the sun's rays and the frosted fruit. With flowers and garden truck this can be much more easily accomplished than with fruit. In this respect the gardener has a decided advantage over the orchardist. The following is an excellent statement of how the plant is injured:

HOW FROST INJURES PLANTS.—"Low temperature congeals the watery part of the cell sap and also the intercellular water content of the plant. Within certain limits this is not or may not be injurious, providing the protoplastic contents of the cell are able to absorb the water and do this before the cell structure collapses as a result of insufficient cell turgor. Frequently the frosting of plants is followed by a sudden rise in temperature, in which case much of the water which was part of the cell sap in the normal condition of the plant escapes through the cell wall into intercellular spaces, or even from the plant entirely, and thus the protoplasm of the cell, being unable to assume its normal condition, becomes disorganized, and decomposition follows."*

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*Professor E. R. Lake, in the Oregon Climate and Crop Bulletin, July, 1900.

Frost, then, *is primarily a matter of air drainage.* This principle is shown both in the general pressure distribution over the country during frost periods, and on a smaller scale in the motion of the surface air currents in certain small areas. In other words, the usual warm lower air strata are vigorously displaced by cold, dry air; and when the draining ceases and the cold air settles during the period of comparative stillness, frost forms. What is true on a large scale is true on a smaller scale, and a close agreement exists between frost belts or frost streaks and areas of stagnant, cold air. A careful survey should be made by every ranch owner. The writer has urged this matter, believing that each grower must work out his own salvation, and that besides studying and practicing methods of protection, it is necessary to be familiar with the air drainage of the ranch. On nearly every ranch that the writer has visited there have been certain well-marked cold spots, which, in most cases, were found to correspond with slight depressions in the ground. These three deductions can be drawn from what precedes: (1) Where the air is in brisk motion, damage from frost is generally light; (2) Stagnant air, such as exists in low valleys, basins, and inclosed areas, favors frost; (3) As the coldest layer is generally near the ground, it is sometimes advisable to drain downward upper, warm air, displacing surface layers.

METHODS OF PROTECTION.—Every fruit-grower should put himself in communication with the nearest center of distribution of weather forecasts. If possible, he should be in daily communication with some Weather Bureau office. Whenever frost warnings are issued for his locality he should carefully determine the temperature and dew-point frequently during the late afternoon and night. A good outfit consists of a metallic thermometer, so arranged as to automatically close an electric circuit and ring an alarm whenever the temperature of the air reaches 32°. In addition to a reliable sling psychrometer there should be some small device for testing the motion of the gentle air currents in the orchard. Too much attention can not be given to this question of air motion. Many smudging devices have failed to be effective, because of a slow movement of the smoke away from the orchard.

It is well known that lowlands are visited with frost while hillsides and hilltops escape. Every fruit-grower should study the topography of his land, and plant accordingly. Windbreaks are, as a rule, considered detrimental. No hard and fast rule, however, can be laid down. By planting a windbreak in the proper place, defects in the topography may be overcome and air currents established where otherwise pools of quiet air would have formed. A windbreak dense enough and so situated as to interfere with any natural circulation and facilitating the formation of still areas or pools would, of course, prove injurious.

A large number of small fires, advantageously placed, will raise the temperature of the air several degrees. The Riverside Horticultural Club, testing the various methods which were in use in California, came to the conclusion that wire baskets suspended a few feet above the ground, and holding several pounds of coal or charcoal, made an efficient protector. This method was described by Mr. Edward Copley, of Riverside, Cal., in several articles published in the Riverside Press of April, 1896. The cost of the wire basket is about ten cents, and if forty baskets be used to the acre, the cost of fuel will hardly exceed $2.50. To this must be added the cost of labor during the night and succeeding day in refilling the baskets. This method meets with most favor in Southern California. The temperature can be raised certainly 3° or 4° with from twenty to forty of these baskets to the acre. It has been suggested that a number of small oil lamps be used with success for this purpose. Oil pots have been used and make a hotter fire, but the deposit of lampblack upon the fruit is objectionable. Some cheap modification of the ordinary plumber's furnace might possibly be devised, which, by means of a moderate blast, would produce a high temperature.

Damp straw, old wood, prunings, manure, etc., when burned briskly, furnish an effective smoke, and if the material while burning is doused with water, the result is a dense steamy smoke, which, while trying on human lungs, serves as a screen to prevent loss of heat by radiation and as a barrier between the chilled fruit and a sudden application of heat at the time of sunrise. Wet smudging has been tried in many ways, with varying results. There are many reports of failure, and, on the other hand some definite results showing the good accomplished by this method. Here, as in all other methods of protection, much will depend upon a careful study of the local conditions. Many a farmer smudges so that some neighbor gets the benefit of his work while his own fruit remains unprotected. All motion of the air should be noted carefully, and this is sometimes difficult where the smoke is very dense. In some orchards sacks of old straw soaked with oil are so distributed as to be available for quick lighting. Portable smudges have also been devised.

Of all methods proposed for the protection of fruit, excepting wire baskets, irrigation has the largest amount of evidence in its favor. It has been tried in many different places with different crops, and has generally given satisfaction. Where water is not very plentiful, and this is the case strangely enough in some fruit sections, the method may not always be practicable, but with this exception there are many decided advantages in the generous use of water. Injury from frost depends almost as much upon the condition of the tree as upon the severity of the weather. Critical periods in the life of the tree can be controlled to some degree by the use of water.

Some fruit-growers hold that heat is the one thing that is desired at times of frost, and that the best method is that which produces heat by the simplest and least expensive process. Water, owing to its high specific heat, forms an excellent agency for the temporary storage of heat energy. We have seen that in the wet smudge an attempt is made to utilize the latent heat of vaporization, and theoretically this has always seemed the most advantageous method. A modification of the wet smudge is steam piped through an orchard. It is claimed that the temperature was raised 3° whenever the steam was turned on. It is also said that the coal consumed would not be more than the amount used by the basket method. The estimated expense per acre would be about $75.

After frost, or rather just before a frost has ended, a spraying device can be used to advantage. Its chief function is to prevent a too rapid warming of the chilled fruit. It is said by horticulturists that even the light coating of ice formed in this way does not seriously damage the fruit. It is very likely that the latent heat of solidification set free by the change from water to ice may play a helpful part; but the chief effect is to prevent a too rapid thawing. In other words, both heat and water should be supplied to the chilled plant slowly, and according to the plant's ability to make good use of the same. At the A. J. Everest ranch at Riverside, Cal., a portion of the grove is protected by sprinklers at the top of fifty-foot masts.

All screening or covering devices are in effect modified hothouses, and there is no question but that a thorough protection can be accomplished. The expense is the one objection. Screens are made of light materials, namely, canvas, muslin, or light woodwork, and have been used with considerable success. At the A. J. Everest ranch an elaborate structure of lath screens is in use. There is no question as to the value of the protection, but the expense is considerable, averaging perhaps $400 to the acre. This lath covering may be considered as forming a well-ventilated hothouse.

INJURIOUS TEMPERATURES.—A list of injurious temperatures, taken from Professor Hammon's pamphlet upon "Frost," is also of interest, and I wish the members of this Convention would test the figures given in this table, so that we may determine, by actual test, their reliability.

Table of Temperatures at which the Following Plants are Liable to Receive Injury from Frost.

Compiled from information received from horticulturists, orchardists, and gardeners throughout the entire Pacific Coast.

The temperatures given are, as nearly as possible, those of the air in contact with the plant itself.

Plants or Fruits.	In Bud	In Blossom	In Setting Fruit.	At Other Times
Almonds	28°	30°	30°	28°
Apples	27	29	30	26
Apricots	30	31	32	30
Asparagus	29	29	29	26
Bananas	31	31	32	31
Barley	------	29	------	------
Beans	------	31	------	------
Beets	------	------	------	25
Cabbage	------	----	------	15–27
Cantaloupes	32	32	------	30–31
Cauliflower	------	------	------	20–27
Celery	------	------	------	28
Cucumbers	31	31	31	32
Cymlings or Squash	31	31	31	30
Flowers*	31	31	31	30
Grapes	31	31	30	28
Grape-fruit	30	31	31	28
Lemons	30	31	31	28
Lettuce	------	------	------	12–28
Mandarins	31	31	31	28
Oats	31	------	------	------
Okra	------	------	------	31
Olives	30	31	31	‡18 §24

Plants or Fruits.	In Bud	In Blossom	In Setting Fruit.	At Other Times
Onions	------	------	------	29°
Oranges†	30°	31°	31°	‡26 §29
Parsnips	------	-----	------	27
Peaches	29	30	30	29
Pears	28	29	29	28
Peas	29	30	30	25
Plums	30	31	31	29
Potatoes:				
Irish	30	30	30	31
Sweet	31	31	31	31
Prunes	30	31	31	29
Radishes	------	------	------	52
Shrubs, roses, or trees	26–30	28–32	------	30–26
Spinach	------	------	-----	21
Strawberries	28	28	28	30
Tangerines	31	31	31	28
Tomatoes	31	31	31	31
Turnips	------	------	------	26
Watermelons	------	------	------	28-31
Wheat	------	31	31	------
Walnuts, English	30	31	31	28

* Depends on variety. † Injured at 2° higher if continued four to six hours. ‡ Ripe. § Green.

In conclusion, organization is needed among fruit-growers in the matter of protecting their fruits at critical periods as much as in any other matter that affects them. The fruit-grower who will not smudge at a critical period when his neighbor is smudging, is, whether he knows it or not, getting certain benefits from his neighbor's work, while doing his best to handicap that neighbor and prevent the successful issue of that neighbor's efforts. I am glad to say that the citrus-fruit growers, and especially those of the Riverside district and members of the Horticultural Club, have always been to the front in this matter of frost-fighting, have organized frost districts, and I believe are ready this year to attempt to protect their oranges by concerted and well-directed action. I wish to strongly urge the deciduous-fruit growers to emulate the example of their brethren of the South.

A vote of thanks was tendered to Professor McAdie for his very interesting address.

MR. ADAMS offered the following resolution, which was referred to the Committee on Resolutions, and reported favorably:

Resolved, That this Convention directs public attention to the importance of such a speedy and thorough revision of the water laws of the State as shall make titles to the use of water secure, and that we respectfully urge Congress to recognize the vigor and ability with which irrigation interests are now promoted, under great disadvantages, by the Department of Agriculture, by providing and equipping in that department a full Bureau of Irrigation, or Agricultural Engineering.

It was moved by MR. FITCH that a committee of five be appointed for the purpose of organizing coöperative associations, and that the present Committee on Pacific Coast Markets should be retained for this purpose, with power to add to their number.

Motion carried.

The Convention then adjourned until 7:30 P. M.

EVENING SESSION—THIRD DAY.

THURSDAY, December 5, 1901.

Convention met, as per adjournment, at 7:30 P. M. President COOPER in the chair.

NOTES ON PLANTATIONS OF CAPRIFIG TREES.

BY DR. GUSTAV EISEN, OF SAN FRANCISCO.

It is not necessary to dwell upon the importance of caprifying the true Smyrna figs. Experiences during the last two years have fully demonstrated the necessity, value, and practical feasibility of caprification. The nature and culture of caprifig trees are, however, less understood, and remarks upon these topics may be of more general interest. Such horticulturists as are interested in the process of caprification can do no better than consult the paper entitled "Smyrna-Fig Culture in California," by Dr. L. O. Howard, in the Yearbook of the U. S. Department of Agriculture for 1901.

In order to have a sufficient supply of Blastophaga wasps for caprification, it becomes necessary to cultivate the caprifig trees in which the wasps breed. In the Asiatic, or rather Mediterranean, countries, the caprifig trees do not necessarily need to be cultivated, as they grow wild almost everywhere, and the figs containing the wasps may be had by simply plucking the wild figs at the proper time. But experience has taught the Mediterranean fig-growers that not all caprifig trees are alike, and that it is not always safe to rely upon the wild figs producing sufficient crops of the proper quality at the time the figs are required for the caprification of the Smyrna figs.

Office of the Caprifig.—The question now arises as to the qualities most highly prized in a caprifig tree, and their practical importance to the horticulturist.

It may not be entirely superfluous to point out first the practical relationship of the caprifig and the wasps used in the process of caprification. When the Smyrna figs have attained a certain size their female flowers have become receptive; that is, they require to be pollinated by the pollen from the male flowers, in order that they may set fruit and mature seeds. As the fig is closed, and no pollen can enter through the aid of the wind, as is sometimes the case in other kinds of flowers, it must be brought there by the means of insects. The aid of insects in bringing pollen from one flower to another is a most common thing in nature, and it is safe to say that the majority of flowers are pollinated in that way. It will thus be seen that in order to caprificate the Smyrna figs, we require, not only caprifig trees and wasps, but it is also necessary that the wasps should be covered with the fig pollen when they emerge from one fig in order to enter another. This makes the question more complicated yet, and it is this question of pollen which distinguishes the caprification of the Smyrna figs from the caprification of the wild figs or caprifigs. The wild figs or caprifigs can be caprificated and will set fruit without any pollen being present, but the Smyrna figs would all fall off, and dry without maturing, if pollen was not present in sufficient quantity to pollinate a large number of fig flowers.

Why Different Caprifigs Are Necessary.—The successful cultivator must carefully consider the qualities of his caprifigs, as upon their nature and characteristics depend the profits of years of labor, just as much as upon the quality of the Smyrna figs intended for fruit. The main point that is to be considered is the necessity of procuring an abundant supply of Blastophaga wasps covered with pollen at the time required. If either the pollen fails or the wasps appear too late or too early, a failure will be the result. To avoid these the cultivator must prepare a plantation of the proper kinds of caprifig trees. The first caprifig tree which we know of with certainty in this State was imported into California by the Bulletin Company of San Francisco. This tree was planted at Niles on the Shinn place, and it is safe to say that many trees resulting from cuttings of this tree have been scattered over this State and are now growing in full vigor without having attracted any special attention. Unfortunately this caprifig tree was not of a variety which could harbor the fig wasps during any longer period than a few months. It possesses only one crop of figs a year—the crop known as the profichi or spring crop. The other two crops are missing. This profichi crop sets late in the fall of the year, and becomes receptive to the wasps next spring, some time in March or April, and matures during June or July. Now it is known that the Blastophaga wasps require young caprifigs as soon as they hatch out, in order to have a place wherein to lay their eggs. If, as in the caprifig just referred to, there is no such young figs present, it is evident that the wasps must soon perish before they find any flowers suitable for their eggs. It will thus be seen that there must be different kinds of caprifigs, and that some figs are more suitable for harboring the wasps than others. As a general rule, it may be said that the caprifig tree possesses three more or less distinct crops a year, and that each crop overlaps the other, either on the same tree or on different trees. Each crop of caprifigs hatches a distinct crop of fig wasps, and there is thus a constant succession of figs and wasps, either on the same tree or on different trees.

THE DIFFERENT CROPS OF CAPRIFIGS.—The figs which are used for the caprification are, as every one knows, the profichi crop. It will be seen that the crops of the caprifig are not all of the same importance to the grower. Of the profichi figs we require many thousands, or many hundreds of thousands, as the case may be; while of the other crops we have need of only a few figs. The different uses to which the different crops of the caprifig tree are put, may be stated in a few words. All the three crops of the caprifig are used for caprificating the caprifig itself, while only the profichi are used in caprificating the Smyrna figs. As long as we possess a caprifig tree which bears three distinct crops each year without fail, we need have no anxiety about caprifying the caprifig tree itself. But if our caprifig tree is such that it bears only one or two of the necessary three crops, then it becomes necessary to interfere and procure the missing caprifig crop from some other place. The three crops of the caprifig tree are designated by different names. The fig crop which appears as small buttons in the summer and attains its full size during the winter is known as the mamme figs. These figs harbor the wasps during the winter—in other words the wasps hibernate in the mamme. The figs which set in the fall as small buttons and which mature in the spring are known as the profichi figs. The figs which set in the spring and which mature during the same summer are known as the mammoni figs. All the Italian investigators have mentioned that there are three distinct kinds of caprifig trees. Some bear only one crop of figs a year. These are called by them "uniferi." Others bear two crops a year, called "biferi"; while those which bear all the three crops are known as "triferi." Now we know that the Bulletin fig mentioned above bears only one crop, and thus belongs to the type known as uniferi.

The question arises why should we not discard all varieties which bear only one crop and plant only those which bear the regular three crops. To answer this question is not as easy as it may appear. It will suffice to state here that experiences have shown that it is desirable to have caprifigs of the three kinds. Figs which bear only one crop a year are, as a rule, much stronger and bear their special crop with more vigor and abundance than such trees as divide their vigor and fertility between the three crops. As we require a large number of profichi figs it seems but natural that we should preferably plant caprifig trees which bear this crop in abundance. If such is our choice, then we may have to look to other trees for mamme and mammoni figs. This is exactly what is done in Smyrna. There the fig-growers plant principally caprifigs which bear a large profichi crop, and depend upon their wild fig trees to furnish mamme and mammoni figs.

LOCAL ADAPTATIONS.—Another point to consider in the choice of caprifigs is that these fig trees are especially adapted to certain localities, in which they thrive, while in others they prove a failure. In California caprifigs have not yet been tried enough to know which varieties are suited to any certain locality, and which are not suited to that same locality. Because a certain caprifig does well, we will say in Sacramento, it is not by any means certain that it will do well in San José. The planter who starts his caprifig orchard with the expectation that he requires only a single caprifig variety may be much disappointed when the time comes for caprificating his trees. He may find that the variety he has planted possesses too few profichi, though he knew that this same variety possessed that most desirable quality in some other place. The grower who intends to plant Smyrna figs would, therefore, do well in supplying himself with a variety of caprifig trees of as distinct types as he can find.

It must also be remembered that some caprifig kinds are more susceptible to frost than other kinds. Heavy frosts will kill the winter mamme figs and destroy the wasps. In order to replenish the young profichi figs with wasps, it will then be necessary to import new mamme figs from some frost-free place and caprificate the profichi figs anew. This leads to the desirability to have caprifigs planted in various places, both in the foothills and on the plains. Places especially suited to caprifigs are those which are sheltered. Mr. A. E. Schwarz was the first to demonstrate that the caprifig requires a sheltered position in order to properly shelter its wasps. In exposed localities the wasps are apt to be blown away before they have a chance to enter any of the young figs. Accordingly, the best places for caprifig trees are sheltered nooks, among hills or in otherwise protected places. Or if such places are not to be had, then it is best to plant the caprifigs close together and shelter them from the prevailing winds by windbreaks of evergreen trees. The caprifig trees should be planted in hedgerows, say fifteen to twenty feet between the rows, while in the rows they should stand much closer. After the trees are once planted they should never be pruned, as this would let in air and sun. The wasp requires shade and shelter in order to thrive. If this is furnished, then it is safe to say that the little insect will take care of itself.

A COLLECTION OF CAPRIFIGS.—In California we have now growing not less than eighteen different varieties of caprifigs, all of which have been gathered together in one collection on the place of Mr. John Rock at Niles. This collection includes all the figs imported by different persons from abroad, as well as some varieties originated in California. These varieties have been carefully described in a paper which is now being printed by the United States Department of Agriculture. Many of these varieties are of exceptional promise, and will no doubt be widely distributed.

SUMMARY.—It may facilitate the understanding of the culture of the caprifigs if we here recapitulate the main points which I have endeavored to bring out in the foregoing.

1. It is highly desirable and in many cases necessary to plant several varieties of caprifigs.
2. It is to advantage to have caprifig plantations in at least two different places, in order to insure as much as possible against the frost, and for the purpose of having ripe caprifigs when they are wanted. With an assortment of caprifigs, and with several plantations, one of which should be in a locality sheltered from severe frosts, we need have no fear of the dying out of the wasps.
3. Caprifigs should be planted close together in odd nooks and corners near, or in, the orchard; or if no suitable locality is found there, as near the fig orchard as convenient.
4. Caprifigs require no pruning. They should be headed low, or allowed to divide from the very ground, and suckers should be encouraged, in order that there may be plenty of shade for the wasps.
5. The practice of grafting the caprifig on the limbs of the Smyrna fig is entirely unsuitable, as it is doubtful if the wasps would live in a few exposed branches. It is also doubtful if the profichi from the caprifigs would ripen at the proper time and in sufficient number to insure caprification of all the Smyrna figs which we wish to have caprificated.
6. Caprifigs should preferably be on their own roots, and not grafted as standards on other fig stock.

THE FIG.

ADDRESS BY GEORGE C. ROEDING, OF FRESNO.

I left California last May for the purpose of investigating the question of the Smyrna fig as it grew in Smyrna. I left early in the season in order to be in Smyrna during the season of caprification. We had discovered many things about this subject theoretically, but there were many practical points that we did not understand. I left Berlin on the 2d of June and arrived in Constantinople on the 4th and was in Smyrna on the 11th. I went on this trip as the special agent of the United States Government, and immediately called upon the American consul to see whether he could give me any information in regard to the caprifigs. My principal object was to see how caprification was carried on. He said I had arrived too late, and naturally I was very much worried about it. As I could not go out into the interior right away, I took an interpreter from the consulate's office and got into a cab and traveled around the suburbs of Smyrna, desiring to find a few caprifigs, in the hope, possibly, of learning that I had not arrived too late. After traveling awhile, I was successful in finding a caprifig. The insects were just about to emerge, and I realized that I had arrived just in the nick of time. The following day I went to Aidin, and told the consul my object in making this trip. I knew I was in a rather dangerous position, and that if they found out what I wanted every obstacle would be placed in my path. I represented to the interpreter and all other people that I was a special agent of the United States Department of Agriculture from New York, and whenever I had an opportunity I discussed with those people the subject of caprification. I stated to them that I had heard that there was an insect required for the production of the Smyrna fig, and that I thought it was ridiculous. All of these men told me that I could believe what I pleased, but they said, "We know that if we don't have this insect we don't have Smyrna figs."

After spending a few days there I went out to several fig orchards, in which caprification was just going on. I asked the gentlemen a great many questions about caprification and the methods of carrying it on, and I was surprised to learn the intense ignorance displayed on the subject. They knew nothing of the subject outside of the fact that without the insect they had no figs. They did not know how to account for the insect, or anything else about it. I asked them what became of the insect when the fig disappeared, and they said the insect disappears. I asked them how they got it back again, and they said, "We don't know; it comes out of the woods." As I say, upon my arrival at these orchards caprification was going on, and I began to examine the

Smyrna figs for the purpose of determining one point that was of great importance, and that was to ascertain the receptive stage of the Smyrna fig. I found that when the figs were about the size of a marble and the flowers of a waxy white appearance, and the Smyrna fig of a shiny green appearance outside, was the time it was in the receptive stage. I also found that instead of one insect going into a fig, in almost every instance there were from four to five insects in each fig. Another point about which I was in doubt was to determine whether caprification was only practiced once or a number of times, and how many caprified figs it required to caprify a Smyrna fig tree. I found it was carried on from two to three times in a season, when the caprifice crop was bearing. On an average, in trees forty years old, not more than from twelve to sixteen caprified figs were hung in the trees at any one time.

Returning to Aidin, after making these investigations, the following day, unfortunately for me an article which had appeared in the Saturday Evening Post in the United States was copied into the Turkish and Greek papers, and the gentleman at whose house I was stopping learned through these papers who I was. Of course I had gone there really under a misrepresentation, telling I was from New York and making believe I knew nothing about the subject. Through my interpreter I learned that this gentleman was very much worried, fearing that through the information and assistance he had given me he might get into trouble with his Government. After a few days he concluded to give me all the information necessary, but after that time I traveled under an assumed name.

The extent of this fig district will probably be of interest to you. The orchards commence about 48 miles from Smyrna at a place called Iencaliz, and extend up as far as Densley. The extent of the fig district is about 106 miles, and the fruit is grown entirely in the Meander Valley. The district is about three fourths of a mile wide, along the lower foothills, and you only find the figs growing around these hills and none at all in the valley itself.

The methods of cultivation are very crude indeed, the people simply doing as their ancestors did. The trees as a rule are thirty to forty years old. Wherever a tree has died they re-plant with young trees, and their trees are never pruned. After the freeze of 1898 nothing was done with the trees, and you can see the dead wood sticking out through them all over the country. Another thing, instead of training the trees so as to prevent sunburn, they are allowed to branch from six to seven feet from the ground, and instead of one stem, they have seven or eight stems. I asked a gentleman why this was, and he said, "That is the way my father did it, and that is why I do it."

Another very interesting thing is to see the manner in which caprified figs are sold on the market. The caprified figs are, as a rule, found growing throughout the towns, and they are picked by the peasants and carried to the markets early in the morning, and by seven o'clock the buyers come and will pass from one basket to another and determine which they want, and for which they will pay the highest price. The price depends entirely upon the number of insects the fig shows—the most insects bringing the highest price.

I started to look up the varieties of the caprified figs, but I gave it up. There are almost as many varieties as there are trees. To show you how these caprified figs are valued and what they think of caprification in Smyrna, I learned that in 1898 they had a terrible frost and all the trees were practically frozen. In order to get some for the Smyrna figs, they sent to the island of Keos and paid as high as $80 to $100 a ton for them, when the ordinary price is about 2 cents a pound. Another thing that puzzled me is that there is no irrigation practiced there. The average rainfall is from 20 to 25 inches, and the only irrigation is for the vegetable gardens.

A MEMBER. What time of the year is the rainy season?

MR. ROEDING. From October until May. I left Smyrna in the latter part of June and returned in August for the purpose of investigating the methods of drying and of packing. I found that the method of drying was very crude indeed; it was very simple, with very little expense attached to it. The figs were allowed to drop, and were also shaken and knocked off the trees. The picking takes place, as a rule, early in the morning, and after they have got the figs off the ground, they shake the trees and pick them off, and knock off those that are sufficiently dried, and then the fruit is taken to a kind of a shanty and spread on a mat. No attention is paid as to whether the figs touch each other or not, or whether they are upside-down or any other way. That makes no difference at all to them. The time of drying is from two to three days. The only figs that are turned are the large figs. They take their hands and shovel them up in almost any way to get them turned over. They are then put in piles until they are ready to be taken to the market, where they are placed in sacks and taken to the nearest railroad station. Trains leave these stations daily. There is no class of fruit handled with greater rapidity than the fig. The day I went from Aidin to Smyrna during the fig season over a dozen tons of figs came into Smyrna that night. To give you an idea of the magnitude of the business, I will say that this season the product will be from 25,000 to 30,000 tons, and that there will be about 30,000 people employed there during the fig season.

DR. SHERMAN. How do they pack them?

MR. ROEDING. The first part of the packing comes in the sorting of the figs, which is done by women. The figs are dumped into big piles, then sorted into round baskets, and then carried by boys to the fig-packers. The packing of the figs is really done by men entirely; all that the women do is the sorting. In sorting them the bad figs are thrown on one side and the good figs put into the baskets.

DR. SHERMAN. Do they grade them according to size?

MR. ROEDING. Yes, sir; according to size. The method of packing the figs is practically the same as we adopt, except that the finest figs are packed in what we call the "Lacoon" method. All the finest figs are packed in this manner, and they bring the highest price. I bought some of them and was given a wholesale price on them. I paid in Smyrna 19 cents a pound for them. In New York I found the same fig in one of the wholesale houses, and upon inquiry from the gentleman in charge I found that he had paid 19 cents a pound for them in Smyrna, but he said the price was too high for this country.

A MEMBER. Do they dip them at all?

MR. ROEDING. No, sir; no processing of any kind. There is no sulphuring or dipping at all. All their figs are filled with worms. I asked one man why they didn't kill the worms, and he said that it took too much time. When a ship leaves there with figs it simply crawls with worms. Of course they could destroy the germs of these worms if they would steam the figs or dip them in boiling water.

A MEMBER. Is there any bleaching or sulphuring of them?

MR. ROEDING. No, sir. Some figs are put up in boxes and labeled "washed figs," but that statement is not true. The fact is, none of them are washed or processed at all.

A MEMBER. How do they get the dirt out of them ?

MR. ROEDING. In handling them; and in order to keep the figs from adhering to their fingers, they are handled with moistened fingers, kept moist by dipping them in a brine. Where they dip this salt water up from the sea and take it to the packing-house, all the sewers empty. I will say that a number of the packing-houses are cleaner than they have been represented to be by some. Some of them are dirty, but the better class of packing-houses are in many instances very nice, and they are kept as clean as they can be in handling that class of goods.

A MEMBER. Do figs sour there?

MR. ROEDING. Yes, some; but not so much as our Adriatics. They all sour there if they don't happen to have the north wind, which is a dry wind. If they have a west wind, they sour and spoil as much as ours do. They have smut there, too. I asked one man what caused it, and he said it was because the packers smoked in the buildings. That is not so, however.

A MEMBER. Can they raise figs cheaper in Smyrna than here?

MR. ROEDING. Yes, with their cheap labor they probably can. But the good Smyrna figs there bring on the average 2½ to 3 cents a pound, and we can make a very good profit on figs at that figure here in California.

A MEMBER. What does the packer pay the producer?

MR. ROEDING. From 2½ to 3 cents. Those figs that will not do for packing are used in making coffee and also in making brandy.

A vote of thanks was extended to Mr. Roeding for the information given on the fig industry in Smyrna.

THE ORANGE IN SOUTHERN CALIFORNIA.

By J. W. JEFFREY, of Azusa.

In the short time I might properly have in which to present this great subject to the Fruit-Growers' Convention, I can not hope to set forth a satisfactory treatise upon the orange in Southern California. Nor would a synopsis of what has been written upon this important feature of the horticultural achievements of the State be of value, as almost every one has access to the bulletins and pamphlets that have been printed concerning this industry. However, had I the ability to present the subject in the form of a log book of the experiences of the last few years, many items would appear not even hinted at in the publications at hand. Until some one shall have written a complete text-book upon the orange in California, I am pleased to see this subject continued upon the programmes of the State Conventions, though I admit that in attempting to honor my part of this one I do not know what you expect or why your committee has selected me to present it.

Few people of the north realize the rapidity with which orange culture has advanced in the region south of the Tehachapi, or its effect upon the industrial progress of that section. In spite of our boasted climate and all agricultural and kindred interests, the orange industry is responsible in the greatest measure for the stability of our institutions, for the large increase in population, and for the rapidity of progress that is apparent in every line of development. With the exception of the lemon, no other horticultural product is increasing, and it is difficult to realize the extent to which the orange has superseded all other fruits. In 1889 I was delegated by a local committee to make up an exhibit for a citrus fair to represent my home locality, known as "The Azusa Valley." After two days of hard work I had secured six boxes of Navel oranges thought to be of exhibition quality. This represented all the fancy stock in the valley, and it was proudly exhibited as the first fruit offerings of an ambitious but only promising section. In 1901, just a dozen years later, the territory canvassed with such meager results shipped 2,200 carloads of oranges and 500 carloads of other citrus fruits, only 20,000 boxes shy of a million, and weighing 68,000,000 pounds. This record of increase has been paralleled at Pomona, Ontario, Redlands, and other citrus centers, not to include the remarkable development at Riverside, which is yet producing one hundred per cent more fruit than any other section, bringing the total output for 1901 up to 21,175 carloads of oranges alone. The world has never before witnessed the concentration of so much capital, energy, and enterprise upon an equal area of agricultural lands in the space of one decade as that lavished with so much success upon the citrus territory of Southern California.

Ten years ago the orange industry was fairly in its experimental stage; ten years ago began the great increase in population that gave to Los Angeles City front rank in percentage of gain of all the important cities of this country, and to every citrus-growing center a population far outstripping Los Angeles in percentage of gain, though not appearing in the returns from lack of data with which to make comparisons. It is more than coincident that these developments of soil and population should mark time together. The former could not proceed without the latter, in the orange business, for it required increased labor to maintain the intense cultivation and harvest the product that produced this record. The orange should be recognized, then, as the cardinal factor in the development of Southern California from the census-enumerator's standpoint.

We are told that Belgian *fruit* culture is more intensive than that of any other portion of the world. Indeed, I know of nothing so intensive in this country, except the cultivation of the Belgian hare in Southern California two years ago, in which we had a monopoly, until the demand became so brisk in the north that our profitable hutches were depleted at a cost of from $5 to $150 per hare. Nothing has proven more lucrative than the intensive cultivation of the hare or the orange, except that of resistant grapevines at 75 cents a cutting, and you may look upon it as a law of compensation that what the north lost on hares will soon be regained on vines, and we play even in the honors of intensely cultivating each other in the promotion of these two great industries. But this digression prevented me from setting forth the fact that were it not for the use of modern methods of irrigation, economy in the use of machinery in cultivation, and labor-saving appliances in preparing the crops for marketing, the orange-growing centers would present a duplicate of the Netherlands in the rural population necessary to produce and care for the present fruit tonnage. I have known one acre of orange trees to produce 70,000 pounds of merchantable fruit at one picking. No cultivated crop that I have seen is equal to that of a thoroughly cared-for orchard of Washington Navel oranges. Twenty thousand pounds of corn and potatoes, grown at the same time upon an acre of drained peat lands at El Monte, is far below this mark. Without presenting too many facts that might require verification after adjournment, we all will agree that the Navel orange tree is the most magnificent feeder and producer, except the pomelo, of any orchard tree. Consequently it requires a proportional amount of labor to supply the food, keep the tree in health, and care for the product.

My home is in the midst of an irrigation district of nearly 4,000 acres of bearing orange trees. On the south, and breaking away from it like a step down from a great green wall, is a tract of 4,000 acres of fine wheat land farmed by one rancher. By the use of a great, modern traction engine this farmer expects to cultivate, seed, harvest, and thresh the cereal crop of this tract, requiring the labor of four men annually to do the work. A ten-acre orange grove requires the constant labor of one man to irrigate, cultivate, harvest, and pack the crop that is produced every year. Thus, the complement of the 4,000-acre tract of orange trees is 400 men, as against 4 for the farm tract of equal area. As the southern orange-grower has taken the contract to sell his own fruit in coöperation with his associates, and makes big money by attending to this business, as well as that of growing the fruit, it is safe to say that 600 helpers are required in all the departments of the business to care for the 4,000 acres of orange groves in question. From this typical example of industrial California, and its contrast with plain farming, one may understand the principal cause of the progress Southern California has made in population and wealth during the last decade.

Without giving up my attempt to sketch the latest experiences in orange culture, it may be stated that the south has practically settled upon two varieties as the standards for general cultivation. The first in importance is the Washington Navel. Public sentiment, both from the growers' and from the consumers' standpoint, has always given this orange the preference. The tendency of this variety to sport back to worthlessness, and the consequent mistakes of the early propagators in their selection of stock from which to grow trees, are the only valid arguments that have ever been used against the general adoption of this orange. Later years have shown that a typical tree once established will always remain so, and that has thrown the burden of purity of stock upon the nurserymen. Planters understand this so thoroughly that they now spend more time in the selection of their nurserymen than formerly, and the younger orchards are coming to maturity with a minimum of "sports" and in many cases a full complement of typical trees. Tens of thousands of dollars have been spent in budding-over off-quality Washington Navel trees, but the progress of to-day recognizes very little necessity of starting an orchard subject to this fault. Perhaps these weaknesses in this variety have caused its utter failure in

Florida, and this may be another case of compensation. At least it is not a cause of anxiety upon the part of California growers.

The other standard orange is the Valencia Late, a somewhat seeded variety, and hence not subject to the inconstancy of the Navel, and rarely if ever missing in typical quality through the faults of the parent tree. This orange, in a few localities, vies with the Navel for supremacy of acreage, but generally is of small importance in the crop totals. It is not prepossessing in color, it is uniform in quality, size, and productiveness, and could it be shipped skinless would sell better upon its color, texture, and solidity. There are two or three hybrids of the Washington Navel and the Valencia Late which might have been more popular had they not been queered by the explanations of their origin.

As this is in the nature of current comment upon the orange in Southern California, I shall not mention the other varieties, except to state that most of them have gradually lost consideration at the hands of the practical grower. Some progress has been made in the cultivation of the Tangerine, and in a few cases it has been very profitable. The other varieties of the Mandarin type are yet in their experimental stage and can not be ranked among the profitable kinds. The pomelo, the largest and most prolific of all the oranges, is halting at present, with good prospects of becoming a perpetuity in the ordinary run of the business.

The stock now being planted is almost universally first-class. The mistakes made in planting scrub orange trees were in evidence years ago, and the lesson has been so impressed upon the orchardists that the nurserymen seldom advertise or attempt to sell poor trees.

There is nothing new in the practice of preparing the ground for trees. Experience has shown that the land must be graded with special reference to its irrigation. There are many misfit orchards among the oldest plantations in this respect, entailing great loss in the congestion of fertilizers, inequalities in irrigation, and impossible irrigation in some cases. The intelligent planter no longer prepares his land improperly or by fixed rule, but proportions his grade as far as possible to the character of his soil and the methods of irrigation he wishes to use. I need not describe the different plans of orchard formation. The square, the five square, and the triangular each has its advocates; but since the orange has been found such a ravenous feeder that its roots soon ramify its feeding-ground entire, we hear little of the arrangement of the trees, but much of their planting distances.

Aside from the fact that the square formation has the advantage of all others in economy of cultivation, especially in alluvial soils where the ground near the trees does not need cultivation, it has been found advantageous from the fumigator's standpoint. There is nothing more bothersome to the tent men upon a dark night than to keep tab upon every tree in a five-square or triangular arrangement. As to subsoiling, that is not practiced extensively of wet years, and may be superseded altogether by the orchard plow. At any rate, the square method allows sufficient room for the subsoiler, even far more than one furrow to the row, which gives the same results as is claimed from the other systems of planting. Plant in squares 20 feet across if your land is not strong, 22 by 24 feet where the soil is heavy and the tree growth abundant. Many orchardists who planted 18 by 20 feet are reaping the benefit of their folly by hauling their fruit out upon narrow sleds, and Southern California is not an ideal locality for sledding. It is impossible to fumigate many of the old orchards because of the interlocking of the branches, and the error of close planting will hereafter be carefully avoided for this and other reasons too well known to require notice. On the experience that the greater feeding area a tree is given, the less its liability to dangerous fluctuations in vitality and consequent effects upon the quality of the fruit, the average planter would advise 22 by 24 feet as the proper distance to plant, both from the economics of orchard work and from the quantity of merchantable fruit produced.

There is something new in cultivation. Last year Southern California grew the largest and the least resistant crop of oranges ever produced. Among the other reasons given for this, is shallow cultivation, and, following, shallow irrigation. In the wake of these extremely dry seasons came a persistent hardpan, even in alluvial soils. This produced a tendency to strangulation of the deeper roots and a consequent activity of the surface feeders. These surface roots were fed the fertilizers the whole root area should have had, and, being constantly stimulated by irrigation, constantly stirred to hardpan by the teeth of the cultivator, and scalded by the hot sun, the functions of the entire tree were in a state of unrest and partial impotency. It is not impossible that this constant arresting and forcing of the development of the fruit caused the sweetening of the pulp observed in October, the lack of oil formation in the skin cells, and the non-union of the rind and pulp—all so noticeable in last season's crop. At any rate, as soon as the 20-inch rainfall of last winter penetrated the hardpan the trees resumed their normal functions with their old-time vigor, and now it is a laborious process to separate the rind from even a ripe orange, and impossible to find an abnormal crop in other respects. These points may be thought somewhat theoretical, but they have brought conviction to a large number of practical men, who will hereafter, in the event of a dry, hot season, use the orchard plow to train the tree roots down to a safer feeding surface by preventing the formation of a dust pan. In spite of the adversities of last season, I knew several cases of deep plowing which held the fruit intact until May, while many in the same locality were compelled to harvest their crops in early winter where shallow cultivation had prevailed. If the experiences of the past three years have demonstrated that dry-year crops may be improved by superior cultivation, a repetition of the troubles that befell the orange-grower last season may be avoided in the future.

In the pruning of orange trees there is no new item to present. Elaborate articles have been written on this point, but the practical orchardist does little or no pruning. To look after the water sprouts that may distort his trees, and to trim out the branches that die of inanition and thus give the tree an inside bearing surface, are about the limits of orange-tree pruning as practiced by the best growers. The orange tree will produce fancy fruit grown so near the earth that it may ripen in the sand, and indeed the best fruit is usually found upon the lower branches.

The question of adaptability of soil is no longer an open one. It has been settled so thoroughly by experiences that the new investor can avoid mistakes by a tour of investigation. Generally, lands which bear light, regular crops produce a somewhat superior orange, while the heavier lands produce slightly inferior fruit, but heavier crops. Modern methods of fertilizing have modified these characteristics until it may be broadly stated that there is only an immaterial difference in the fruit grown throughout the true citrus belt. A problem in regard to fertilization presents itself this season for the first time. The facts are that hundreds of groves where hardpanning had occurred for two or three years carried the annual or semi-annual applications of fertilizers to the beginning of this year with but partial assimilation. The light rainfall, the sparse irrigation, and other deficiencies caused by three consecutive dry years, together with the light cultivation, must have prevented the utilization of the fertilizers. This has brought a strange experience—the finest condition of trees ever seen, with the lightest crop ever grown from an equal foliage surface. The conclusion is that the trees last winter were supplied with a superabundance of wood-growing, but not sufficient fruit-producing, elements. There is a field for investigation here that the scientific authorities should exploit.

The question of insect disinfection is too large to cover in a paper of this character. In a majority of the citrus-growing sections unclean fruit bears its own penalty in washing charges, in falling to lower grades, and in the disrepute it brings to the orchardist. Fumigation is more universal this fall than at any other time. It has been reduced to a science, and while the practice is not always successful, poor work is no longer tolerated without a penalty upon the fumigator. There is little complaint of impure cyanide, but much of its improper application. Daylight fumigation, or more properly warm weather fumigation, is under ban, but many otherwise practical growers have not discovered it. Two or three of the leading citrus counties do this work at the treasury's expense, afterwards collecting from the lands treated. Los Angeles County still requires the orchardists to do their own fumigation. No new scale pests have developed since your last reports were out, nor is there evidence that parasites have taken the contract to disinfect the orchards of Southern California.

Upon the question of marketing you have heard a greater voice than mine, one that has been heard all along this coast and its influence felt. It is not boasting to say that Southern California has set the pace for coöperative effort among all other farming communities. Great as the actual achievements in this line have been, greater is the feeling of permanent security that has been engendered by the success of the Citrus Fruit Exchange. Were it not for the work of this coöperative institution, there would be no breadth nor vitality in my subject to-night. The association has given to the agricultural world its greatest example of the elimination of the unnecessary elements of a great industry, without the formation of a trust. It has increased the profits of the producer without taxing the consumer to do it. The manipulator, speculator, and even honest but depleting fruit merchants have been apportioned to thirty or forty per cent of the orange crop. They hold on to that through a strenuous endeavor that would appall even our great President. The idea of charging producers just what it costs to sell their fruits has unified the policy of 4,000 orange-growers, and made the Southern California Fruit Exchange the greatest fruit merchant the world has ever seen, giving that organization the record of handling millions of dollars every year, with losses from collections and disbursements so small that they do not amount to the value of 15 carloads in an aggregate sale of 25,800 made since the Exchange assumed control of its own fruit from the orchard to the market end of the line. The orange in Northern California is feeling the impulse of this great movement, and may soon be listed with the Exchange, for it is said that where even a few are assembled together the Lord will be with them just the same.

THE ORANGE IN NORTHERN CALIFORNIA.

By D. H. MURRAY, of Oroville,
Superintendent of Oroville Citrus Association.

The culture of citrus fruits, especially the orange, in the northern parts of California, particularly so in the foothill regions of Placer, Yuba, Sutter, Glenn, Tehama, and more especially Butte County, is rapidly assuming a place of importance.

Fifteen years ago last September, on my departure from Riverside, in Southern California, to assume the position I now hold, I was told by many that the people north, in Butte County, thought they could raise oranges, but that they would soon find their mistake and give it up as a bad job.

It did not take long to discover that oranges were growing here, and now it is an acknowledged fact; and a desire for a practical knowledge of their propagation and culture has so steadily increased in the above mentioned counties, that you can now find large orange groves of all ages, from one to fifteen years, and they certainly rank with the best groves in the State. These groves are not only growing, showing a dark, rich green color, but they are yielding an abundance of fruit, which gives the happy owner, in return for his labor, a well-filled pocket.

Butte County can boast of having at the present time five thousand acres of the golden fruit, and turned out last year, as I have been told, in the neighborhood of five hundred carloads. This year the county expects to put these figures away in the shade, as the crop is estimated to be much heavier this year than it was last. The bulk of the crop will be gathered from the magnificent groves of Palermo and Thermalito, together with outlying districts, and from Oroville and vicinity.

In regard to the other counties, I have not been able to obtain the number of trees planted, or the output of fruit for the last year. Still, I have been informed that the crop is much heavier this year than it was last season. These counties will certainly do their share in turning out a larger percentage of fruit this year than last. We will not only have a larger quantity, but the fruit will be of a far superior quality to any that has been turned out before.

Tehama and Glenn counties are forging to the front. The well-known Maywood Colony, in Tehama County, has planted in the last two years in the neighborhood of twenty thousand citrus trees, which, I have been informed by the owners, are doing well.

The question is often asked by strangers on arriving at some abandoned grove, "What is the cause of the trees all dying?" I may say that in this county, as well as in the above mentioned counties, hundreds, yes, even thousands, of dollars have been spent on some such groves, and these to-day are almost out of existence. The reason in some cases is neglect. Many have been informed that all they have to do is to get the ground, plant the trees, and at the end of two years they would have paying returns. They find out about that time that it takes considerable cash to take care of an orange grove as it ought to be cared for, and the consequence is that they try to cut down expenses by letting the cultivation go. In consequence, the trees all turn yellow and eventually die. The following year the grove looks so bad that the owner in many cases abandons the place altogether, and swears the orange business is a fraud.

I would always advise a person, with the view of having a model grove, to test and examine the land thoroughly. You may be told it is a beautiful looking tract, but remember it may be only skin deep, and below the surface you will find hardpan, cemented gravel, pipeclay, or some such subsoils which are undesirable and have caused many an orchardist disappointment and loss. In fact, so much so that I have known them to abandon the place altogether.

Everything depends upon the character and situation of the land to be planted, and according to these you must select and arrange your grove.

The orange delights in a warm, deep, fertile, and well-drained soil, and under these conditions will give to growers a bounteous crop. A cold and damp soil breeds disease, and death is sure to follow. Always select a position for an orange grove in a rich, deep, porous soil, where the trees will grow strong and vigorous. Better never plant a tree than put it in a heavy, low ground, or where water can be reached within three or four feet of the surface. The orange must not at any time stand in water, which in a very short time will cause the roots to die, and your tree will soon be beyond recovery.

The orange is sometimes root-killed by winter rains, although as a rule it is well on in the spring when the trees show the damage by turning yellow and the limbs begin to die. Drainage, as I will hereafter state, will overcome the trouble by lowering the water table and keeping the roots dry.

Throughout the northern counties the soil is of a red, gravelly loam, particularly so in the foothill lands, and is charged heavily with oxide of iron, which gives our oranges a much richer color than that of the orange in many other parts of the State.

We are more inland and have a much higher temperature during the summer, which certainly ripens our fruit five or six weeks earlier than the orange matures in the South.

The soil on the river bottoms is sandy on top and adobe below in many localities, which has a tendency to make the fruit coarse and thick-skinned, as well as much later in maturing than is usual on the higher ground.

A few words concerning drainage will not be out of place, as drainage is of the utmost importance: It increases the fertility of the soil, and promotes the health and vitality of the tree. In fact, this can not be too strongly impressed upon the minds of those who desire to make a success of orange culture. I have put in a great many drains in the past fifteen years, and it is really remarkable the improvement they have made in the trees. Not only that, but you can work your ground easier and during a longer period, as the soil is usually loose and mellow. It is too commonly regarded as sufficient to sink the drains merely out of the way of the plow, or, at most, out of the reach of the subsoil implements. But there are reasons founded upon ascertained facts why drainage systems should be deeper laid.

The oranges to be grown in the northern counties may well be headed with the Washington Navel, which may be styled king of all varieties, and on account of its earliness it is certainly the leading variety for us to grow. The Jaffa is an early variety, and is a great favorite with many. Another variety which has taken a leading position among the growers is the Dancy Tangerine and Satsuma or Oonshiu, which are both early and very fruitful. There are many other varieties grown which really ought not to be encouraged as profitable trees in this section, on account of their lateness.

A few words in regard to pruning, and then I am done. If carefully watched in their growth the trees will require little pruning. Remove all crossed branches, to prevent chafing, which might terminate in the dreaded gum disease. Pruning is certainly overdone in a great many cases, especially by those who go about styling themselves "pruners." They care little for the tree or its appearance, but have a great care for the "dollars" in sight. Not one in twenty understands the object and gain of well-considered pruning. Pruning regulates the form of the tree and causes it to become more fruitful, with larger and better fruit. If practiced to too great an extent, the desired result is not obtained, for every tree must have a sufficient amount of foliage to absorb the flow of sap, otherwise it will send forth a great number of suckers, which are certainly injurious to the tree. Blossom buds are produced less abundantly, as the foliage is necessary to promote the health and vigor of the tree. On the other hand, all dead and surplus limbs, which are only harbors for dirt and vermin, should be removed from the center of the tree, to encourage fruitfulness in the center of the tree as much as possible. It should be borne in mind, however, that the citrus family has always a luxuriant and heavy growth of foliage.

As a conclusion to the above remarks, the best rule that can be given is this: Watch your trees carefully, give them plenty of care, and keep them clean, healthy, and vigorous. The golden harvest will soon follow, and with it success and profit.

THE ALMOND IN CALIFORNIA.

By ALDEN ANDERSON, of Suisun.

From the standpoint of the botanist, the almond has been classified as a fruit, and the tree a native of southern Asia. Its propagation has been extended, however, and it is now extensively raised in all countries near or bordering on the Mediterranean Sea in Europe. After crossing the Atlantic a broad leap is made, and the only place in North America where it is raised in commercial quantities, outside of a few in Arizona, is California. It will, therefore, be seen that it favors a temperate climate and immunity from killing frosts.

The first plantings of almonds in this State were generally for ornamental purposes, or, perhaps, a few trees for variety in the family orchard. One of the first in California to recognize its commercial value was Mr. A. T. Hatch, then of Suisun, who became interested from observing the fruit of a few trees in his own and his neighbors' dooryards.

This first planting consisted of two hundred trees of an imported variety, the Languedoc, as were the first plantings generally, on his home place in Suisun Valley in 1872; and as indicative of the probable life of an almond tree in California, it is interesting to state here that the most of these trees are yet living and bearing as well now as at any time since attaining bearing age.

Not satisfied with the quality of the output of this orchard, Mr. Hatch went to experimenting, and several years after, it is of record that he had on exhibition at one time one hundred and ninety-three different varieties of almonds. From all these he gradually eliminated the poorer ones, until he had left six or seven varieties, which were eventually reduced to three varieties, consisting of the Nonpareil, I X L, and Ne Plus Ultra. These he himself proceeded to extensively plant in various parts of the State, and as the subject attracted more and more attention, and he became recognized as an authority, it was but natural that his varieties were mostly planted.

To the above enumerated was soon added another variety for general planting that has made its way by sheer force of merit. This is the Drake Seedling, first raised by Mr. H. C. Drake in Suisun Valley, and from a tree that was a sport from the roots of a nectarine tree.

Although it would now be possible to get together at least fifty different varieties of almonds during the harvesting season in California for exhibition purposes, some of them having much merit, the above named form the bulk of the almonds planted in or shipped from California at the present time.

From this list, for planting purposes, can be eliminated the Languedoc, which is now seldom if ever planted.

Which of these varieties are the best to plant? This question can not be answered correctly without knowing the location, climatic conditions, etc., of the intended orchard. Some varieties do better in one district than they do in another, and some will do well in one district and be a rank failure in all respects in another.

The two most popular varieties, generally speaking, with both the trade and the producer, at present are the Nonpareil and the Drake Seedling. It would not be advisable, however, no matter how sure we were that the particular variety we favored matured to perfection in the chosen location, to plant solid blocks of any one variety of almonds. Too little attention has been paid thus far by the planters of almond orchards to the matter of cross-pollination, so as to have mutually fertile varieties, that bloom at the same time, planted near together. To this fact can be traced most of the failures in this branch of orchard work. In most almonds there is a tendency to self-sterility, the tendency varying in the different varieties. Like the matter of selecting varieties, no exact rule can be laid down; but this much can be said, that no almond orchard so far has been a success that did not have the opportunity of cross-pollination, either by proximity or through the medium of bees or other insects. When the orchard is a large one, bees and insects can not perform the necessary work, and proximity is the only remedy. What varieties should be planted in proximity for this purpose can not well be given, as different kinds blossom at different comparative times in the several districts, and some varieties partake so much of the nature of others as to be entirely useless for this purpose. Experiment and observation are the only recourse.

As regards location, the best site for an almond orchard is on the first raise of land or lower slopes of the foothills, if the soil be of the proper kind. Such locations are generally the most immune from killing frosts.

The soil should be a sandy or gravelly loam, and the almond will do well in much drier soil than any other fruit. The chosen varieties of nuts should be worked onto the bitter almond stock in the nursery.

The trees in the orchard should be planted at least twenty-four feet apart, and be pruned or cut back the first two years. After this, a yearly thinning out and the removal of superfluous wood and suckers is sufficient.

The harvesting of almonds should commence as soon as the outer covering bursts enough to disclose the nut. Great care should be taken to see that the almonds, after hulling, are fully and carefully dried. When ready to put on the market they should be carefully bleached. They should not be exposed to the fumes of the sulphur for more than from twenty to thirty minutes, according to the bleacher arrangements. Many almonds are ruined by over-bleaching, and as this process is entirely unnecessary except as a matter of appearance, it is to be hoped that some other way of brightening them will be discovered and adopted. It would be better if the system could once be well inaugurated of taking the almonds from the trees to cracking machines, and the kernels or meats alone marketed. It would mean much to the industry. Not only could the crops be harvested cheaper, but much more satisfaction would be given to the consumer. The demand would be increased, and no further complaint of rancid nuts would be heard.

It will be seen that the almonds most extensively grown at present were originated in this State. There are several other new varieties, partly without names at present, that give splendid promise of being profitable to producers and acceptable in all respects to the trade, which really means the consumer.

On the whole, the industry yet offers good inducements to those who will go into the subject intelligently and exercise care in selecting the location of the orchard, and of varieties, and the planting and caring for the trees in the orchard.

THE WALNUT INDUSTRY.

By FRANK E. KELLOGG, of Goleta.

In the language of the late B. M. Lelong, Secretary of the State Board of Horticulture, in his fifth biennial report (1895–6), "the walnut is a native of Persia and is supposed to have been introduced into our State by the Franciscan monks during the establishment of the California missions in 1769."

Mr. Lelong's researches show that of the early plantings outside of the Missions, the first was made in San Diego, probably in 1843, by the late Colonel J. J. Warner, and that the second planting was made near Calistoga, in Napa Valley, in 1848, by F. E. Kellogg, Sr., now deceased.

Although the planting of walnuts began in the northern part of the State almost as early as in the southern part, climatic conditions were not so favorable, and the southern counties are to-day almost the sole producers.

The early plantings were very small, and it was not until quite recent years that the industry assumed important proportions.

Santa Barbara County was the first section of the State to enter upon the business on anything like a large scale, and it also enjoys the distinction of having originated what is now commercially known as the soft-shell, and which was for many years known as the Santa Barbara soft-shell.

The soil required is a deep, sandy loam, with a slight mixture of adobe, with no underlying hardpan, and where the surface water is found at from ten to twenty-five feet in the dry season of the year.

The climate best suited to the production of English walnuts is that where the annual rainfall is from fifteen to twenty inches, where frosts are very light in winter and spring, where very hot winds do not prevail in summer, and where there is an abundance of warm, moist fog during the summer months. Some of these conditions are lacking in every State north and east of us, and only very few counties of this State possess the proper climate, and of these counties only small portions of them meet the necessary requirements. The peculiar conformation of the coast-line and mountain ranges south of Point Conception, together with the modifying influence of the outlying islands, combine to give these favored localities in Southern California a climate that seems to be as perfectly adapted to the walnut as that of Persia itself, its native home.

There are three principal varieties grown in Southern California, known respectively as hard-shell, paper-shell, and the soft-shell previously referred to. The most profitable of these varieties is the soft-shell. The trees are the thriftiest, bear the youngest, mature the nuts earliest in the season, and produce the most abundantly; the nuts are the most easily harvested, require the least care and skill to prepare for the market, look the best, and command the highest price.

The planting, cultivation, and general care of the walnut does not differ materially from that of other orchard trees, except that no pruning is required further than to remove the branches which interfere with thorough cultivation.

For many years the walnuts were considered to be immune from all diseases and pests. But in the last few years there has appeared in some localities a well-defined disease peculiar to the walnut, as it seems to attack no other kind of tree. This disease is giving the growers much uneasiness, as it has thus far defied all efforts at eradication. It does not seriously affect the health of the tree, but only damages or destroys the nuts, acting as a kind of blight. As yet its cause is wholly unknown. Although its ravages have seriously affected only a few localities, it is becoming more or less of a menace to the industry. Government experts, as well as the growers themselves, are making a very careful study of the disease, and it is to be hoped that they will speedily discover both the cause and the cure.

The harvesting, grading, bleaching, and marketing are all simple, requiring little skill.

The average yield of a good soft-shell orchard in its prime, and under favorable conditions, will exceed one ton per acre, and the average selling price will exceed $150 per ton. The net profits per acre will exceed $100.

The trees come into profitable bearing at eight years from the planting of the nuts, reach their prime at twelve years, begin to decline at twenty years, and should be replaced by young trees at twenty-five years. By planting two- or three-year-old nursery trees the orchard comes into profitable bearing in five or six years.

The output of the present year will exceed 6,000 tons, the proceeds of which will exceed $1,000,000. But these results will be greatly surpassed in the near future, when the orchards recently planted come into their full fruitage.

FUTURE OF THE INDUSTRY.—Although the quantity produced is rapidly increasing, there seems to be but little danger of over-production, or that the profitableness of the industry, if wisely managed, will seriously diminish for many years to come. As already shown, the area of successful culture is comparatively limited. You can find a hundred acres adapted to the orange, the lemon, the olive, the prune, the apricot, or the raisin grape, where you can find one adapted to the walnut; hence, the output must always remain comparatively limited.

At the present time vast quantities of nuts—chiefly walnuts and filberts—are imported from foreign countries to supply the American markets. Only four years ago these foreign importations far exceeded our entire product, and I presume they still do. This simply proves that if the home market continues to show a preference for our product in the future, as it has for the past few years, we are in no danger whatever of over-production.

Added to all this, the rapid increase of population in all the States east of us, removes still farther into the future the possibility that the supply will exceed the demand. And as long as the demand is greater than the supply, there should be no diminution of the satisfactory prices now prevailing.

NEED OF COÖPERATION.—There is only one thing that threatens the decadence of present prices, and that is the lack of coöperation on the part of the growers. In this age of shrewd speculation and fierce competition, whatever industry fails to resort to concentration of interest is doomed.

Under the high pressure of twentieth century methods and conditions, everybody but the farmer has learned that competition is the death of trade, and that its life is only found in coöperation; and the time has fully come when, to secure their rights and promote their best interests, farmers must unite, as other classes have already done.

The railroads have combined, and they are able to fix rates and fares on the principle of charging all the traffic will bear, and the farmers of the United States, in consequence thereof, pay enough in excess of just charges on the transportation of their crops to probably build and equip a transcontinental railroad every year.

The steel industry has combined, and it is able to pay the president of the combination, if we include his commissions, a salary which is more than four times the salary of the President of the United States.

The oil industry has combined, and the corporation is rolling up its wealth by the hundreds of millions.

Coöperation seems to permeate the very air we breathe, and all classes of workers, except the farmer, have caught its inspiration. He has stubbornly refused to coöperate, except in a few instances, and as a result he has become the victim of almost everything and almost everybody. A good many people imagine that his lot is a highly favored one; that all he has to do is simply to plow the ground and sow the seed, and then sleep or recreate himself until the harvest time, when he can reap his fields and exchange the products for cash. But the facts are far different. The chinch bug destroys his wheat, and the grasshoppers and army worms sweep his fields. Scale bugs infest his citrus orchard, and the codling moth his apple trees. All kinds of peddlers, and life and fire insurance and lightning-rod agents make him their prey. The papers call him a hayseed, and he becomes a shining mark for the cartoonist. About the only man who extends to him a glad hand is the politician just before election day.

Already an appalling number of farms are under mortgage. I am persuaded that unless the farmers speedily learn the value of coöperation and fall in line with the universal trend of modern industry, a gigantic system of tenantry will take the place of the once happy, independent rural homes, so long the pride and safeguard of the American republic.

The raisin-growers and citrus-fruit exchanges have perhaps advanced the farthest in coöperative effort of any agricultural industries, and the success which they have achieved should be a convincing object lesson not only to the walnut-growers, but to all farm industries. The walnut-growers themselves have demonstrated the great value of concentration of interests in the marketing of their crops and the maintaining of prices. But thus far they have only met with partial success, owing to the fact that so large a percentage of the growers refuse to join associations. These outside growers have it in their power to break the market at any time, which results in a feeling of uncertainty in prices, highly detrimental to the industry.

Furthermore, the combination of the associations themselves is very far from being a satisfactory arrangement, for instead of being just one exchange, as it should be, they are organized into a multitude of individual exchanges, with no stronger authority for enforcing obedience to general rules and regulations than simply the word of honor. Of course, this ought to be as binding as any law, but somehow it does not prove to be an unqualified success in commercial affairs.

Also, the present arrangement does not by any means do away with competition entirely.

It is to be hoped that as the years go by the benefits of coöperation will appeal more and more to the intelligence of the growers until they shall all belong to the exchanges, and that the exchanges, instead of maintaining their individuality in such a manner as to keep alive the spirit of competition, will unite in one common exchange, in which the welfare of one becomes the welfare of all. Under such conditions, coupled with our natural advantages, I am persuaded that there will be a great future for the walnut.

The Convention then adjourned until Friday, December 6, 1901.

PROCEEDINGS OF FOURTH DAY.

FRIDAY, December 6, 1901.

Convention called to order at 9:30 A. M. President COOPER in the chair.

This morning had been set aside for discussion of railroad transportation, but Mr. Stephens, chairman of the Committee on Transportation, not being present, the matter was deferred.

COUNTY HORTICULTURAL BOARDS, AND WHAT THEY HAVE ACCOMPLISHED.

BY H. P. STABLER, OF YUBA CITY.

The statement has been made that California was the first State to invoke the aid of legal means in waging warfare against insect pests. Whether or not first in this work, California has the reputation of having accomplished better results in the effort to exterminate fruit pests and diseases than any other part of the world. Our methods, and the successful remedies in use, are copied and applied in every quarter of the earth where horticulture is established.

Our plan is in advance of the methods in practice elsewhere, and consists of a State Board of Horticulture of nine members, with County Boards of Horticulture in twenty-nine of the fruit-growing counties of the State. The Legislature has wisely granted great power to the State Board, and, by appointment as quarantine guardians, this authority is in turn vested in the members of the County Horticultural Boards. Thus the county commissioners become the agents or deputies of the State Board of Horticulture, and are charged with enforcing the State law and the quarantine regulations of the State Board.

The County Boards with their deputies, known as local inspectors, constitute an energetic, earnest body of men, who are continually working for the suppression of pests and diseases. The work of these officers is characterized by its thoroughness, and the fruit-growers of California have come to look upon the county commissioners as valuable assistants in their industry.

It is not many years since some nurserymen considered an inspection of their stock an intrusion on the part of the county commissioners, and occasionally resorted to unfair methods in avoiding inspection, but to-day the nurseryman realizes more than ever the advantages of being able to offer clean stock for sale, and invites the closest examination of his trees before placing them on the market.

The shipper and dealer formerly paid little or no attention to the pests infesting fruits; but when the quarantine officers at the point of destination of the shipment began to dump boxes of his goods, he realized that clean fruit had an increased value over the other kind. Unquestionably every one in the fruit business is alive to the necessity of thorough disinfection of infested and infected places, and great strides have been made in the past decade in arousing this sentiment in California.

Washes have been thoroughly studied, their manufacture simplified, and their application intelligently accomplished. Parasites have been distributed, propagated, and studied, while fumigation has received careful attention by the fruit-growers of California. In all this work the County Horticultural Boards have been foremost. In carrying out the instructions of the State Board and assisting in experiments the County Boards have always been active.

The work of the Agricultural Department of the State University has been beneficial to horticulture by the coöperation of the County Boards, and by constant communication with the professors of the college. Even the important investigations of the Agricultural Department at Washington and the work of the agent of the Department on this Coast, Professor Pierce, of Santa Ana, have been eagerly received and communicated by the County Horticultural Boards.

In short, the advanced position of California horticulture to-day, while it is due, of course, to very many causes, is largely the result of the untiring work of these officers in the fruit districts.

For eleven years the members of the County Boards have been meeting in annual session at the same time and place as the Fruit-Growers' Convention. At these meetings the officers of the State Board, university professors, fruit-growers, nurserymen, and others interested have gathered for conference and instruction, and a better understanding of our quarantine laws, and of the nature and method of extermination of pests, has resulted. In fact, much of the success of the quarantine officers has resulted from the uniform work carried on in the counties, and from a discussion of methods in these annual gatherings. Proposed legislation, both State and National, is taken up and discussed at our meetings, and ordinances in effect in various counties are compared, with a view of reconciling differences and securing uniformity. A uniform certificate of inspection has been adopted, and is generally used, and new remedies and improved methods of application are exploited.

Many of the County Horticultural Commissioners are making entomologists of themselves, and the work of several of them has been recognized by the National Government. The constant and thorough investigations by this body of intelligent workers in our fruit districts have been of greater value to horticulture in our State than any other feature of our industry. The work is carried on quietly, without display, and while it has seldom received public recognition outside of the reports of the State Board, it has accomplished great results and is destined to achieve more in the future.

THE FRUIT-GROWER AND HIS WORK.

By J. W. NELSON, of San Francisco.

In all of the wide domain of industry there is no calling more important to the welfare of the State and more concerned in its upbuilding than that of the fruit-grower. Seeing that at present it contributes not less than $40,000,000 to the income of the State, and that in a decade this will be increased to not less than $100,000,000, some idea of its value to the State may be formed. The fruit industry of our day in California leads all others, and indeed, it is certain that in time to come California will be the great fruit-growing State of this wonderful country. Already the product of its valleys and hillsides is sold in all civilized markets, and the fame of its fruits has reached the ends of the earth. Owing to the fruit industry, great tracts of country are being raised from a condition of poverty and barrenness to one of fertility and smiling plenty. Twenty years ago the Santa Clara Valley was for the most part for half the year, bare, brown, and forbidding, while its people for the most part also were in a condition bordering on chronic bankruptcy. Some benefactor of his race suggested turning the unprofitable wheat and barley fields into fruit orchards, and to-day Santa Clara Valley is a synonym for plenty and prosperty. We doubt if, for its size, there is a richer county in all California.

Even the golden treasures of '49 do not begin to compare with the orchards of this State. Take Fresno, the home of a happy, prosperous people, once a barren desert, made rich by fruit culture. What would Los Angeles, Riverside, Pasadena, San Diego, Orange, and other famous places in Southern California be without their citrus-groves, their beautiful vineyards and orchards of deciduous fruit? We know what they were in the day when the Mexicans and Indians were thinly scattered over the land. In the main, no more God-forsaken localities could be found on his footstool; but fruit culture, with its magic wand, has transformed them into spots of beauty, only comparable to those pictured in the "Arabian Nights" and "The Wonderful Adventures of Aladdin." The fruit-grower has done his part in helping to bring prosperity to California and comfort to the people. But his work is as yet only in its incipiency; it is his task to make beautiful the waste places and to fill the land with smiling homes, with fruits and flowers. What more beautiful than a country filled with well-kept orchards? Here nestle the vine-embowered cottages of the people. Around, spread orchards and vineyards, olive plantations and orange groves; in spring, a world of blossoms of the most variegated hues cover the trees; the whole country side is a mass of bloom freighted with the hopes of a fruitful autumn. There, as it were, a summer that promises to be perpetual breathes through the land, followed by the fruitage and the brilliant sky of autumn.

Every man engaged in fruit-growing should love his vocation; otherwise, he has missed it. He should be a lover of the beautiful and the useful combined; he should be an enthusiast by nature, and give all possible attention to matters of climate, soil, and description of fruit, suited to all various conditions that environ it; he should know that fruit trees of different kinds affect widely differing locations and surroundings. Like individuals, they have their peculiarities, and will not flourish amidst uncongenial surroundings.

Apricots do best in the country around the Bay of San Francisco; they need the salt air. Peaches do not do so well in the same section; they require the warm air of the valleys; and so on of others. The mountains and the foothills raise the best apples. The warm sheltered valleys from the borders of Oregon to those of Arizona are the homes of the citrus fruits. How beautiful are the trees, especially the fruit trees, now the glory of the land. In all ages mankind has loved the trees, their blossoms, fruit, and foliage. "Let me see the trees; I love the trees, they are so beautiful," were among the last wishes of the dying President.

The orchard is California's heritage, and every man in the State should speak on all occasions of the beauty, variety, and superior quality of our fruits; especially should this be done when we have the stranger within our gates; and the East is sending forth its people by thousands to learn of the practical opportunities of life in California. By proper study of climate and soil, of varieties and their proper treatment, of marketing and producing none but the best, we shall treble the present demand for California fruits.

The orchardist should study soil and climate well. He should procure the best varieties, and cultivate none other. He should study the best methods of packing and preparing for market. There is always a demand for the very best kinds of fruit, no matter how large the production may be. Witness the olive orchards of Italy, southern France, Spain, and other countries. Witness the vine-clad hills of France. For three thousand years or more around the basin of the Mediterranean these fruits have been cultivated; they are found in every favorable location, but there is no surplus of production. They bring the highest prices, and a small olive orchard or a small vineyard is equivalent to a fortune. The horticulturist should send none but the best fruits to market and should leave the inferior kinds at home—make brandy or vinegar of them, feed them to the hogs, or utilize them in some other way. By doing this he will help to create a demand for good, wholesome fruit, and make it popular as a part of the dietary among the masses of the people. In this way, in course of time, it can be made a most important adjunct to bread, the staff of life, and take to a large extent the place of meat on the tables of the millions. Thirty to fifty dollars a ton is considered a good price for fruit, that is to say, 1½ to 2½ cents per pound. It is thus much cheaper than meat. Let fifteen million families consume on an average three pounds per day, and we have an annual consumption of 16,425,000,000 pounds. This will give an idea of the extent of our market. Of course, I do not anticipate such a consumption to-day, but meat is constantly growing dearer, and soon will be out of reach of the poorer classes of our population.

A man must be born with a taste for the business of fruit-growing and taking care of trees. He must acquire it by very thorough education; if not, he will certainly fail. This is not the day when you can give the people any old thing in the shape of fruit. It must be good, or they will have none of it. There never was a more splendid opportunity than the present for the fruit-grower, and indeed for all interested in the welfare of the State, to advertise California fruit. The hotels in San Francisco and throughout the interior are filled with Eastern visitors who have come to see what California is like. Every chance that offers itself to show them what California fruit is should be taken. The hotel-keeper should make his tables groan under the profusion and variety of choice fruits: the citrus fruit of the Southland, and the deciduous product of all California. Our splendid mountain apples should be found side by side with the oranges and lemons of Los Angeles, Riverside, San Bernardino, San Diego, and of Placer and other localities of the north, with canned peaches, pears, apricots, and other preserved fruits from the California Fruit Canners' Association, prunes from Santa Clara, raisins from Fresno and other counties, and grapes from all parts of the State. Instead of European wines, the very best vintages of California should take their place, and a pride should be felt in so disposing of everything that our guests shall see California in her very best light. And the private citizen, in extending California's proverbial hospitality to the strangers within our gates, should vie with the semi-public functionary in making as liberal a display of California's choicest products as circumstances will allow. And the fruit-grower should coöperate in the good work, and wherever possible there should be public displays of our fruits. For this purpose fruits in jars are the most convenient, and the beauty and richness of the product leave an indelible impression on the mind of the visitor. And while I am on this subject, I would recommend that those interested should enlist the all-powerful aid of the press, remembering, too, in this instance, that the laborer is worthy of his hire.

In receiving our visitors everything should preach the gospel of California fruits. There is no more beautiful, and withal healthful, or remunerative occupation than that of the fruit-grower. In the scripture of the Old Testament, no more beautiful picture is afforded of prosperous, contented, and happy life than that of the reign of King Solomon, "when every man sat under his own vine and fig tree." The highest conception of earthly bliss is that Eden where primeval man enjoyed on this earth a perfect happiness, not only reposing in its bowers, but taking pleasure in its labors "that he might tend it and keep it." And when we speak of the happiness that awaits the spirit of the just beyond the gates of death, we speak of it as Paradise. The fruit-grower should not be greedy to own wide extending orchards; ten or twenty acres, when properly cared for, can be made as remunerative as fifty, and quality, not quantity, should be his motto. And my parting word to the fruit-grower would be: "Do not try to do too much; produce everything of the best, and happiness and competency will await you."

SCALE INSECTS AND THEIR PARASITES.

By EDWARD M. EHRHORN, of Mountain View.

It is ordained by the Supreme Ruler of the Universe that all living things shall not become burdensome upon one another, and we find that this great law is not only appurtenant to the larger animals and plants, but is found to extend down to the most minute organisms, some so small that a good microscope is required to detect their existence. We find that, through artificial means, these conditions have somewhat changed and in some instances have caused great destruction to various industries. Thackeray is quoted as saying that "parasites exist always," and the truth of his saying is probably best illustrated by the various families of insects preying, as they do, upon beast and plant, but largely, also, upon one another.

Agriculture in all its various branches has no doubt had more than its share of parasites. The cattle-raiser, sheep-raiser, grain-producer, and, last but not least, the fruit-grower, have all had their share of destructive insect enemies, and at times very much more than their share. The tsetze-fly and bot-fly kill thousands of cattle annually. Thousands of sheep succumb to the ravages of the gadfly, scab-mite, and lung parasite. Tens of thousands of acres of grain are annually destroyed by the Hessian-fly, chinch-bug, and innumerable other pests; and we fruit-growers have pests without number infesting our trees and vines, in every part and at all periods. We find them attacking the plant from the minute rootlets to the uppermost twigs, on trunk and branch, on twig, leaf, and fruit. There is no part immune from their attack, or that does not suffer from their presence. Minute as these pests are, microscopic even, they are sufficient to reduce our profits, largely increase our labors, and give us infinite worry and anxiety.

Probably the most persistent, annoying, and destructive group of insects with which the fruit-grower has to contend is the scale insects or Coccidæ, and the object of this paper is to discuss this particular group more in detail.

Scale insects (Coccidæ) belong to the order Homoptera, and are closely allied to the Aphis, or plant-lice, family in their habits, but differ greatly in appearance. Some confine themselves to a single genus of plant, while others attack a great variety, and, when present in great numbers, soon cause the plant to lose its vitality, and if not checked in time, will soon kill it.

Scale insects have been known from time immemorial. The beautiful and impressive color of the curtains of the tabernacle and of the robes of the priests, which brought awe and inspiration to the tribes of Judah, is said to have been obtained from a scale insect (*Kermes ilicis*). This insect is still used as a dye in some remote parts of Europe, and in some parts of Spain the inhabitants, mostly women, help support their families by collecting *Kermes*. The cochineal insect (*Coccus cacti*, Linn.) has been used as a dyestuff for a very long period. Our shellac of commerce is the product of a scale insect (*Tachardia lacca*), and was known in 1781. There are many other species whose usefulness was well known, and it shows that in olden times scale insects were mostly considered beneficial, and although one or two are still so regarded, yet, as a whole, they are very injurious.

Horticulture has made such rapid strides within the last fifty years, and the orchard area has increased to such an extent, that scale insects have, so to speak, found themselves in clover, and many species have taken hold of the new food which man has seen fit to propagate. Very few of our native species have changed their habits or their food plants, and most of the troublesome species we have to do battle with are imported from foreign countries. The orchards of California have been troubled by these pests for more than thirty years, and some species which once threatened our industry, especially the cottony-cushion scale (*Icerya* *purchasi*) and the San José scale (*Aspidiotus perniciosus*, Comst.), have been conquered; but other species have taken their places, and to-day we find our trees infested with many scales of which my time will allow me to make but brief mention.

On evergreen and deciduous trees, the Black or Olive scale (*Lecanium oleæ*, Bernd.). This insect can be found everywhere from the mountain tops to the ocean's edge, on native and cultivated trees, and shrubbery. It is a foreign species, but its native home is not positively known. Some say Australia, some say Europe, and others South Africa. It is easily recognized by its color and two transverse ridges on its back, crossed by a third ridge, forming a capital "H". In the orchard it infests the olive, orange, lemon, apricot, peach, prune, pear, fig, and also all ornamental plants, such as oleanders, pittosporum, rose, geranium, peppertree, and many others. It has numerous enemies, but none seem to be able to cope with it satisfactorily. While it is true that the imported ladybird, *Rhizobius ventralis*, and the native species, *Chilocorus bivulnerus*, and others will keep it in check in evergreen orchards, we find that our deciduous trees do not offer enough protection for these during the winter season. Several true parasites attack it, but are not able to cope with it in a manner to be relied upon. The chalcid fly (*Tomocera californica*) will reduce it from thirty to seventy-five per cent, but the remaining scales contain sufficient eggs to again stock the tree. In Australia, Italy, and South Africa, this scale is kept in check by parasites to such an extent that it is hard to find any. We have succeeded in importing some of these parasites, and hope ere long to see some good results. To show how efficient the South African parasite (*Scutellista cyanea*) is, I will read what Prof. Charles P. Lounsbury, of Cape Colony, has to say. In a letter dated January 30, 1900, he says: "It may be practicable to get the parasite established in California, but the task would be no trifling matter. There is a severe obstacle at the very start, viz., the rarity of the insect here, due to their subjection of the scale. *Lecanium oleæ* is not an orchard pest everywhere in the Colony, and only rarely do I find even isolated scales among cultivated trees; when I find them they are nearly always parasitized. On oleander, particularly where ill kept, in myophorum hedges, and on indigenous growth on the plains, is where I generally see the scale, and then seldom in large numbers. * * * You may imagine that under these circumstances obtaining the parasites, or even tracing their habits, is not easy."

Under date of April 10, 1900, writing to Mr. S. F. Leib, of San José, he says: "While I should much like to comply with your wishes at once" (referring to sending parasites), "I fear that the circumstances of the case will render considerable delay unavoidable. The black scale is so thoroughly subdued—just as the cottony-cushion scale now is with you—that it is by no means easy to get hold of it. Nobody here knows anything but the injurious species, hence help from farmers in finding colonies of black scale is out of the question."

Under date of May 15, 1901, Mr. Lounsbury further writes: "We have not forgotten you, but we have failed to find any more black scale fit to send. Cape Town and the suburbs are quite free again, the scale being few and far between, even in its haunts where the material sent last year was found. I quite expected my assistant would find a little about Port Elizabeth, our next largest town, some hundred miles east of here, but he writes that he has been unable to find more than an old scale here and there, and not a single twig worth picking."

Under date of October 23, 1901, Mr. Lounsbury further writes: "The black scale remains as scarce as ever here. We know plenty of places now where we can find a little of it, but the parasites are always there to keep it down. A few weeks ago we found enough low down in some oleanders to make a sending. The postoffice people would not warrant the packages passing unchallenged at New York with only 'sample post' rates paid on them, saying they thought they might get stopped, or at least delayed on account of their size, so I had letter postage paid—rather a neat little sum. We addressed them to Craw, with the suggestion that he might be able to arrange for them farther south in the State."

From the above we will readily see that if this parasite is ever established in California we may expect great things.

Next comes the Red scale (*Aspidiotus auranti*, Mask.). This pest is better known to the growers of Southern California, as it is one of the worst scale insects of the orange groves. It is one of the armored scales, and is very difficult to conquer. Its native country is not known exactly, but Australia has furnished it to California. When it first appeared with us it seemingly only attacked the orange, but now we find it infesting walnut, grapevine, rose, century plant, and many others. We have several ladybirds which feed readily upon this scale, among which are the twice-stabbed ladybird (*Chilocorus bivulnerus*), and the steel-blue ladybirds, *Orchus chalybeus* and *Orchus australasia*. These ladybirds no doubt cause considerable reduction of the scale, but we need a more effective parasite to cope with it. Mr. George Compere, special agent of the State Board of Horticulture, fortunately has been able to find one in China, and already several hundred have been successfully bred and liberated by Mr. Alexander Craw in the orange groves of Southern California. This parasite is very minute, and can hardly be seen with the naked eye, but it seems to be very active and very prolific.

Another scale very closely allied to *A. auranti*, and by many considered but a variety of it, is the Yellow scale (*A. citrinus*, Coql.).

This scale is not a dangerous one, as it has a very interesting and efficient parasite (*Aspidiotiphagus citrinus*, Craw) coping with it. Strange as it may seem, the yellow scale seldom attacks the wood of the tree, whereas the red scale attacks wood, leaf, and fruit.

The Soft Orange scale (*Lecanium hesperidum*) is another species which occasionally gives trouble, but owing to its parasites soon vanishes again, without having caused much trouble to the grower. This scale attacks a great variety of plants, and is a widespread species, readily recognized by its oblong, flattened shape. The two most common parasites which attack this species are: *Coccophagus lecanii*, Fitch, a very minute chalcid fly, easily recognized by a yellow band across the thorax, and *Microterys flavus*, Howd., a beautiful chalcid, which is very abundant and quite large in comparison with its co-worker.

A comparatively new scale insect, for California, is the Purple scale (*Mytilaspis citricola*, Pack.). This species made its first appearance in some orange trees imported from Florida into Los Angeles County in 1888. This is one of the worst pests of the orange, and I am glad to say that very stringent measures are being taken to completely eradicate it. Some very efficient parasites have also been introduced, which will, it is hoped, assist in checking its ravages. This scale does not attack deciduous trees.

The common Ivy scale (*Aspidiotus hederæ*, Bouche) is another general feeder, and at times becomes quite a pest on lemons. It is, however, kept in check by various ladybirds and numerous other parasites, among which are *Aphelinus fuscipennis* and *A. diaspidis*.

Three scale insects which are very injurious to deciduous trees are the Brown Apricot scale (*Lecanium armeniacum*, Craw), the Frosted scale (*L. pruinosum*, Coql.), and the Italian Pear scale (*Diaspis pyricola*, Delguer). The first two insects attack the apricot, peach, prune, and pear in some sections of the State, but are kept in check by the wonderful parasite, *Comys fusca*, Howd., and wherever introduced, so effective is its work at times that it has been impossible to find sufficient scale on the trees to collect material for introducing the parasite into other sections. It is well for those who find these scale insects established in their orchards to secure a colony of the parasite from Mr. Alexander Craw, of the State Board of Horticulture, as it will save them much labor and expense.

The Italian pear scale (*Diaspis pyricola*) attacks the pear, apple, prune, and peach tree. When the young limbs are badly attacked, it does not poison them as does the pernicious scale, but it causes deep depressions in the bark and materially stunts the tree. As yet we have no parasite which will reduce the pest, although the twice-stabbed ladybird (*Chilocorus bivulnerus*) will keep it down when exposed on the limbs. This scale has the habit of crawling under moss and lichens and thus protecting itself against the attack of parasites. Good oil washes have been successfully used as winter washes for its extermination.

Another scale which troubles the apple, and which is mostly found on old trees, is the Oyster-shell scale (*Mytilaspis pomorum*, Bouche). It is not really considered a pest, and has very many enemies. Our scale-eating ladybirds do their share in checking its spread, but several chalcid flies, viz: *Aphelinus mytilaspidis*, Le Baron, and *Aphelinus fuscipennis*, Howd., and others keep the pest from spreading. I have found this species on rosebushes and the passion-vine, and it is said to infest a number of other plants.

One of the most general feeders among scale insects is the Greedy scale (*Aspidiotus rapax*, Comst.), which infests pear, apple, plum, peach, cherry, and all kinds of ornamental shrubs. One of its favorite foods is the Texas umbrella, but even the blue gum is not exempt from its attack. The twice-stabbed ladybird (*Chilocorus bivulnerus*) and Pilate ladybird (*Exocomus pilatei*) feed readily on it, but I believe its best enemy is the chalcid fly (*Aphelinus fuscipennis*, Howd.). This is probably a native species, as we find it on all our soft-wooded trees and shrubs in very isolated places.

There are numerous other scale insects which have been reported as doing damage, but which as a general rule are not considered pests in the orchard. Among the most common are:

The Hemispherical scale (*Lecanium hemisphæricum*, Targ.), which is found on chestnut, orange, oleander, and others. This scale has numerous parasites;

The English Walnut scale (*Aspidiotus Juglans-regiæ*, Comst.);

The Rose scale (*Aulacaspis rosæ*, Sandb.);

The Willow scale (*Chionaspis ortholobis*, Comst.);

The Pine scale (*Chionaspis pinifoliæ*, Fitch);

The Insignis Pine scale (*Physokermes insignicola*, Craw);

The Cottony Maple scale (*Pulvinaria innumerabilis*, Rath.); and a few Mealy bugs. All of these are probably controlled by natural enemies, as they have never been known to spread in great numbers.

The Cottony-Cushion scale and the San José scale, as mentioned above, demonstrate what we can expect from beneficial insects, provided that we can find the right one in its native land.

Before closing, I wish to call attention to the many close calls California has had in introducing some of the worst scale insects known to infest trees in foreign countries, and which were only prevented from being established in our orchards by the establishment of a quarantine department and its strict regulations, by a thorough system of orchard and nursery inspection, and by the vigilance and conscientious work of the Commissioners and the Quarantine Officer.

Thousands, yea, millions, of dollars have been saved to the fruit-growers of the State through the establishment of the State Board of Horticulture and its Quarantine Bureau, and shall we stop at this? I say, NO. Let us, if anything, widen the field; let us ask our legislators to give us more aid, so that we may not only prevent the introduction of pests, but also add to the army of our microscopic friends, those which are waiting for us in foreign lands whence came their natural food.

THE WHITE-FLIES OF CALIFORNIA.

By C. W. WOODWORTH, of the University of California.

Orange-growers of Florida have given the name "White Fly" to the very injurious species of Aleurodes attacking citrus trees. This term had, at one time or another, been previously employed as a popular name for quite a variety of insects, but it had never gained any general currency. The name will now doubtlessly be appropriated by this new fruit pest, to the exclusion of the members of other groups of insects, and can be very appropriately extended to all members of this family. It will be analogous to the use of the florists' name "Green Fly" for the members of the related family Aphidæ. The interest in the white-fly family rests almost wholly upon the injury done by the white-fly of the orange. Other members of the group have at times done some appreciable injury to the various plants, but certainly it is only during the last few years that there has been any very serious financial loss for which they may be held accountable. The seriousness of the situation in Florida can be realized when it is understood that the white-fly is considered the most injurious insect attacking citrus trees—much worse than any of the scale insects. Perhaps not much worse than the injury due to scale insects in California, since the amount of moisture in Florida renders a scale attack there less severe than here, as it seldom or never results in the death of the infested trees. The injury done by the white-fly in Florida resembles very much that due to the black scale in this State, but I am inclined to think the loss there is greater than with us, because it appears that the smut fungus is very difficult to remove, indeed it seems impossible to remove it entirely. The difference between California and Florida fruit was so conspicuous in the past season in Eastern markets that each could be recognized as far as seen. The presence of smut fungus, as with us, does not entirely destroy the value of the fruit, but does seriously interfere with its sale.

I think that there is no evidence of this species of Aleurodes being found at the present time in California, and it is possible that it could not live under the climatic conditions in which we grow these fruits; but, of course, it would be the correct policy to take no chances in the matter of its introduction, for it is equally possible that it might prove as injurious with us as it has in Florida. We have quite a number of representatives of this family in this State, most of which are of little or no economic significance; but at least one species has, during the last year, proven its ability to damage grapevines in a very serious manner. The subject, therefore, of the Californian representatives of this family can not fail to be of interest to our fruit-growers.

The family Aleurodidæ is one of four closely allied groups which have been assembled by entomologists under the name of Sternorhynchs, the name being given because of the position of the mouth apparently upon the breast of the insect. These four families are:

First—Psyllidæ, a rather unimportant family of small, active insects called "Jumping Plant-Lice."

Second—Aphidæ, the largest family of the series, including all the plant-lice, many species being highly injurious; the best known in California being the phylloxera of the grapevine.

Third—Aleurodidæ, the subject of the present paper; and

Fourth—Coccidæ, or scale insects, the most notorious pests the California grower has to contend with.

The family thus lies intermediate between the plant-lice and the scale insects; it is rather more closely allied to the latter than to the former, but has many peculiarities of its own. The similarity is most evident while the insects are young, indeed a young white-fly might easily be mistaken for the young of a scale insect. The most striking difference between the two families lies in the fact that while the female scale insect is always wingless, both sexes of Aleurodes possess wings when full grown and resemble each other very closely.

THE EGGS.—Insects of this family always reproduce themselves by means of eggs. These are laid singly, and are attached to the leaves of the appropriate food-plant by means of a rather short but very characteristic stalk. The length of this stalk depends upon the species to some extent; but all the species lay such similar eggs that it would not be possible to distinguish them in this stage. If the egg of the lace-winged fly was about half as large as it is, and its stalk was reduced to about one third of the length of the egg or less, and slightly twisted, it would resemble quite closely the egg of an Aleurodes. The color of the egg is nearly white, and the leaf in the neighborhood of where it is deposited is usually dusted over with a white waxy secretion from the mother. This secretion often forms very distinct spots, in which case the eggs may be arranged somewhat in a circle, with the stalks outward. The species that lay their eggs thus regularly in a circle occupy themselves a long while in the process of egg-laying, remaining for days in one spot unless disturbed, and even then often going back to the point from which they were driven. They thus appear to brood over the eggs, which, together with the whitish powder already referred to, form a nest in which the mother sits. Other species move about considerably, and lay only one or two eggs upon a leaf.

The Young Insect.—Upon hatching, the young insects very soon select a place upon a leaf and insert their beaks. They walk about much less than do the young scale insects, scarcely ever leaving the leaf upon which they hatch. Like scale insects, when once settled they are very loath to move, and in some species are entirely unable to do so, except at the moulting period. Thus, they become full grown and transform into adults, in most cases, upon or near the spot where they took their first meal. The insect in this stage is always very flat, oval in outline, in color usually either jet black or of a uniform pale-green tone like that of the leaf. The white-fly of the orange is one of the green species, and, being cemented fast to the leaf by its own secretions, is quite difficult to recognize, except upon very close inspection of the leaf. All members of this group secrete more or less waxy material, and in this case the wax when produced is fluid enough to accomplish this firm attachment of the body of the insect to the leaf. One of the commonest species in California, the one that feeds upon the common sow thistle, is also of this green color, but not so firmly fastened to the leaf.

The openings of the breathing system of these insects are always on the underside, quite a distance from the edge of the body, but communicative with the outside air by means of curiously developed grooves on the underside of the body, which remain open after the insect is fastened to the leaf. There are three of these grooves—one at the hind end of the body, and one on either side just back of the head. There is usually a slight difference in coloration along these lines, so that they can be clearly recognized from the upper side, because of the transparency of the body.

In the black species the wax is usually of a brilliant white, contrasting sharply with the general color of both the leaf and the insect, making the latter an extremely striking object. Sometimes this waxy secretion is in the form of a fringe, more or less matted together, extending around the insect along the extreme edge of the body. This is the case in the Aleurodes which has recently been found in destructive quantities upon grapevines in the northern coast counties.

There are numerous parts of the body upon which waxy glands may be developed. One of the most beautiful species that occurs in this State is found upon our common live oak. In this case the wax is not upon the extreme edge of the body, but projects up from the back in the form of broad, white flakes, of a very definite and regular shape. In this insect there are three small but very active wax glands, situated just over the ends of the breathing grooves, from which proceed long, delicate pencils of wax. The arrangement of the wax glands upon the body will doubtless be found to be one of the most available means of distinguishing between the various species.

THE TRANSFORMATIONS.—The transformations of these insects are accomplished by a series of moults. The insect at the time of moulting becomes suddenly active, not walking about the leaf, but keeping its beak inserted in and retaining its position on the leaf. This activity consists in bending the body up and down and contorting it to some extent, apparently in the effort to disengage itself from the old skin which it is about to discard. Soon there appears a split along the middle line toward the front end of the insect, terminating posteriorly by a transverse one not far from the region of the anterior breathing grooves. Out of this rupture the insect crawls, leaving the old skin upon the leaf. The freshly moulting insect soon finds a place not far off, and establishes itself. The old skin, which is only held by the beak, sooner or later becomes disengaged from the leaf, and falls off and disappears. Before the final moult, at which the insect becomes adult, there has been a great change taking place in all the internal organs of the body, as well as by the development of wings and legs, so that when this moult is accomplished the insect escaping bears no resemblance to its former self.

THE ADULT INSECT.—The body of the perfected insect is slender, the legs long, and the newly formed wings very large and conspicuous. Every part of the body is covered with a white powdery secretion, making it snowy white. As the white-fly rests upon the leaf the wings lie like a roof over the body, in such a position as to make the insect appear very broad and robust. The insect is very active, flying better than the members of either of the most nearly allied families. As in the case of plant-lice, the winged form is the chief or only ordinary means of distribution from plant to plant. Some species may be seen in the air in swarms, at times in company with plant-lice.

Like the plant-lice, also, these insects continue to feed after they obtain their wings, but it is during the earlier stages of their lives that they do the most damage to vegetation.

THE WHITE-FLY OF THE VINE.—Our most injurious species is the one that attacks grapevines. This insect has never been described, nor has any mention of it been made, in any publication upon the insects of the vine. As with all white-flies, the injury done by this insect is that which is caused by its fluid excretions. This, in the case of the present species, seems to be somewhat poisonous to the under surface of the leaves, producing an effect somewhat like that following the work of the red spider. On the upper side it is usually less evident, except where the insects are excessively abundant, when the whole surface may become blackened by an alteration of the contents of the leaf cells. This blackening is, in addition to the blackened appearance of the leaves, due to the accumulation of dust or the growth of smut fungus on the surface of the leaf like that which occurs on a plant affected by the black scale. These poisoning effects, of course, are scarcely to be noticed, except when the insects become excessively numerous.

ITS LIFE HISTORY.—The life history of but few of the species of Aleurodidæ has been made out. Many of them produce but one brood a year, passing the winter as a nearly full-grown insect, which transforms quite early in the spring into the winged adult condition. Some that pass the winter in this way have a number of broods during the summer. Others in California are active and breeding all winter as well as summer, and this is true of those living on greenhouse plants.

A large number of the species in the colder climates, which live on deciduous trees and on annual herbs, have never been studied in the winter, and their winter history is entirely unknown. It is probable, however, that in most cases they had become fully fed before the leaves fall in autumn, but do not transform until the next spring, remaining merely attached to the fallen leaves during the winter.* The Aleurodes of the vine do not have this history, but possess the habit, hitherto unknown in this group, of transferring their attention, on the approach of winter, to an entirely different plant, the evergreen *Rhamnus californicus*, and returning to the vine the next spring. The insect is two-brooded; the adults that are produced on the grape leaves flying to the Rhamnus before laying their eggs, and those developing on the leaves of the Rhamnus likewise being impelled by instinct to seek a home for their young on the grapevine. This remarkable habit is similar to that possessed by a number of species of plant-lice and by some other insects, and may possibly be found true of a number of other Aleurodidæ.

REMEDIES.—The remedies for white-fly will ordinarily be the spraying of the plants in the same way as for plant-lice or scale insects. The flies are not difficult to kill, but are often hard to reach with a spray, because of their preference for the underside of the leaves.

In the case of the species attacking the vine the peculiar habits of the insect, described above, give the key to the most available method of control. If it is desired to kill the insect by spraying, the winter food-plant affords the best place to attack it, since while the shape of the leaf makes it very difficult to spray a grapevine satisfactorily, the

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*Since writing the above I learn that my brother, Mr. H. O. Woodworth, has been able to confirm this supposition for a number of species found on deciduous trees in Illinois.

Rhamnus is a very easy plant to spray thoroughly. The spraying of the vine would have to be done during the busy season, while the other generation can be sprayed at leisure.

The method that will be usually adopted for the extermination of this insect, however, is not by spraying, but by the destruction of the winter food-plant, since it is of no value and could be easily cut out.

Upon motion, the paper by Professor Woodworth was received and placed on file.

MR. BERWICK. I move you that the Chair appoint a committee of three on the matters connected with the Nicaragua Canal.

Motion carried.

HON. WM. JOHNSTON. I move you that the Chair appoint a Committee on Exhibits.

Motion carried.

WHAT CALIFORNIA HAS DONE FOR HORTICULTURE.

By ALEXANDER CRAW,
Quarantine Officer of the State Board of Horticulture.

Not only in the United States, Canada, Central and South America, but also in Europe, Australia, New Zealand, South Africa, and other countries, California is recognized as the most advanced horticultural country in the world. Representatives from all parts of the civilized world have been sent to this State, in most instances by their Governments, to study our methods of growing fruits, from the delicate citrus products to the hardy apple. Not only are our systems of planting, pruning, cultivating, and irrigating being closely studied and adopted, but also our methods of picking, curing, packing, and shipping have been copied, and other countries have been benefited by the enterprise of our people. Not only have new varieties of fruits been originated here, but some of the older sorts, under our improved system, take on characteristics that commend them to the eye and palate of the people of other countries.

In this short paper I will not attempt to enumerate the great number of choice fruits and flowers that have been brought into existence by artificial methods, or by the improved system of conducting all horticultural operations in this State, but will confine myself to what has been done to prevent the introduction of insect pests, also to the artificial and natural methods of controlling those that were imported before any restrictions were placed upon trees and plants entering the State.

California was the first State to pass laws for the promotion and protection of horticulture. This was in 1881. The horticultural law was amended and improved as the original law was shown to be defective, or that it could be improved, until now we have a law that is considered as near perfect as it is possible to get through a legislative body. As proof of that assertion, I may state that it has been so decided upon various points by several Superior Courts and by the Supreme Court of the State. Our efforts in this direction have been watched by other States and countries, and now few are without similar laws. A bulletin containing these horticultural laws and court decisions has just been issued by the State Board of Horticulture, and can be had upon application.

The Act creating the State Board of Horticulture gave that body the power to make regulations governing disinfection and preventing the spread of contagious tree diseases and fruit pests, and regulations were accordingly adopted aiming to prevent the further introduction of such pests. The people of several States claimed that our regulations were intended to cripple their tree business, so retaliatory measures were threatened if we did not relax our inspection regulations and admit everything in the tree line. Instead of resorting to such measures, however, they became more careful, and the necessity of protecting themselves yearly became more evident to them, so that now they have laws of their own, and we hear nothing of retaliation from the other side of the Rockies.

The adaptability of California soil and climate to the cultivation of fruits was early recognized by the Padres, and orchards were planted near their Mission buildings and by a few pioneers in other sections. Upon the change of governments, and occupation by Americans, fruit-growing made rapid strides, and upon the completion of the first overland railroad it received a great impetus, and new varieties of fruit and other trees were introduced from all parts of the United States and the Orient. With the plants came their insect pests and diseases. Our climate, that is so conducive to the production of fine fruits, is also favorable to the increase of insect pests, and they multiplied accordingly. Soon their injurious presence was made manifest by the yellow and stunted appearance of the leaves and trees. This was in the early seventies, and the orchardists had practically no method of combating such pests on the extensive scale that was necessary. Remedies were both crude and expensive, and the manner of applying them was both slow and wasteful. The old-time perforated "rose," for use in applying liquid remedies to orchard trees, was out of the question, so the Marigot nozzle was invented and manufactured by Wesley Fanning, of San José. This is now generally known as the "San José nozzle." Instead of the solution being applied to the tree in a heavy shower, it issued in the form of a fine spray, reaching nearly every portion, thoroughly saturating all the leaves and twigs without much waste. This nozzle was generally used when soapy solutions or kerosene emulsions were required. When the "lime, sulphur, and salt" remedy was found to be effective and was used for the "pernicious," or so-called "San José," scale, the San José nozzle was soon cut by the gritty nature of that solution. Here again our people were equal to the difficulty, and the Bean spray pump manufacturers, of Los Gatos, invented their "Duck Bill" nozzle. The name suggests the shape. The solution at the outlet strikes against a plate of hard rubber, which is more durable than brass. The fineness of the spray is regulated by a thumb screw. The short nozzles made it difficult to reach the tops of the trees, so the late Mr. Titus, of San Gabriel, Los Angeles County, thought of a simple way of overcoming this, by attaching half-inch gas pipe to the end of his rubber hose, and on this was screwed the nozzle. The pipe was of varying length, according to the height of the trees to be sprayed. Afterwards a bamboo rod, with a thin brass pipe passing through it, was invented, but it was not strong enough to stand lifting or displacing the dense branches of orange twigs and leaves necessary for the spray to reach every part, so this was discarded. From the old-time syringe and fountain pump used, with a bucket for carrying the solution, Californians advanced, and spray tanks holding from two hundred to five hundred gallons, and drawn by two to four horses or mules, was the next improvement to expedite the work of disinfecting orchards. The Bean pump, and other pumps with large air cylinders, was a long step in the right direction, as the compressed air and liquid in them keeps up a steady and continuous spray.

J. W. Wolfskill and L. C. Goodwin, of Los Angeles, were the first orchardists to use steam as the motive power in orchard-spraying machinery. This was in 1881–2. Their steam boilers and pumps were used from one to two years and then given up, because of difficulty in regulating the force. This defect was remedied by Mr. W. R. Gunnis and his son, R. H. Gunnis, of San Diego, who constructed a very satisfactory gas engine provided with a fly or balance wheel. Now a number of powerful gas and steam spraying machines are in use in this State, requiring very little attention in their management, and giving great satisfaction.

The use of sulphur as a check and remedy for "red spider" and all leaf-eating mites, mildew and other external fungi upon trees and plants, is well known to horticulturists, and was generally applied to the affected trees by the use of sulphur bellows or dusted from a sack at the end of a pole. It remained for Mr. George Ditzler, of the Rio Bonito orchards, Biggs, Butte County, to invent a machine that distributed the sulphur in a wholesale manner. Mr. Ditzler's machine is an ordinary grain-sower, with several attachments of his own invention.

The machine is mounted on a wagon drawn by two horses, and operated by gear from the wheels. Mr. Ditzler claims that by his invention he can sulphur more trees in one hour than one hundred men could in a day by the old process, and do it more thoroughly. The various parts of the machine are figured in Bulletin No. 67, of the State Board of Horticulture. There is no patent on the device, so any one is at liberty to make it.

My experience in the fight against the cottony-cushion scale (*Icerya purchasi*), in 1883–4, convinced me that some other method than spraying would have to be devised, if we were to be successful in keeping the pest in check in the orchards and gardens of the State. It was almost impossible to reach every portion of the citrus trees with spray pumps, owing to the dense foliage, and the trees in a few months after treatment were as seriously affected as before.

In 1885 Mr. J. W. Wolfskill, of Los Angeles, and the writer, began a series of experiments with gases and fumigation, and succeeded in killing the cottony-cushion scale and their eggs. A list of the gases used was published in the U. S. Agricultural Report for 1887. Mr. D. W. Coquillett, a former resident of Orange County, California, was greatly impressed with our work in fumigation, and conducted some experiments. One of the first was with hydrocyanic acid gas. The tree to which it was applied was badly damaged, but after a series of trials we succeeded in perfecting the work. This was in 1886. After our success Mr. F. W. Morse was detailed by Professor Hilgard, of the University of California, to conduct similar experiments. He also discovered the same gas, and was the first to publish the result.

Spraying and fumigation give only temporary relief, and are expensive. The writer urged the growers to send an expert to Australia to look up the natural enemies of the cottony-cushion scale, as it was from that country that the pest was introduced into California. A meeting was held in the Los Angeles Board of Trade rooms in 1887, nearly all the prominent orange-growers being present. Mr. A. B. Chapman, of San Gabriel, was chairman. Ways and means were discussed, and a committee appointed to raise funds for the purpose of sending an expert to Australia to secure the natural enemies. About that time two other Californians entered into the history-making work. The late Frank McCoppin, of San Francisco, was appointed United States Commissioner to the Melbourne Exposition, and in conversation with the late J. de Barth Shorb, of San Gabriel, asked what he could do in Australia to advance the interests of California. Shorb replied, "Take an expert with you, to find the enemy of the cottony-cushion scale, or we are all ruined." Mr. McCoppin generously put aside $2,000 of the funds appropriated by Congress for the use of the Commissioner, and Mr. Albert Koebele, of Alameda, was selected by the United States Department of Agriculture to undertake the work, and his discovery of the *Vedalia cardinalis* and its introduction into California saved the orange and lemon groves of the State and made Mr. Koebele famous the world over.

This is not the only instance of the benefits derived from beneficial insects in checking destructive scale and other pests. The soft brown scale was a very serious pest when first introduced, and destroyed bearing orange trees until it was checked by two species of internal parasitic flies. The yellow scale is not feared now, for a parasite from Japan keeps its numbers down. The once-dreaded San José scale is not so troublesome now, in fact it can hardly be found in the orchards around San José, and no spraying or fumigation has been done for years. A very small four-winged fly, belonging to the same order as the others I have just mentioned, keeps it in check. The brown apricot scale, that filthy pest of the prune, apricot, and peach trees, is rapidly disappearing from the orchards of Santa Clara, Alameda, and other counties, where its parasite has been established. I can enumerate about a dozen other internal parasites that have relieved the fruit-grower from ruinous expense.

We are now at work propagating two other internal parasites, which, if we succeed, will be worth hundreds of thousands of dollars to California. One is the insect that keeps the black scale in check in South Africa. I have recently received from Prof. Charles P. Lounsbury, Government Entomologist at Cape Town, two boxes containing these valuable insects. A number reached us alive and are now in a glass breeding case containing oleander infested with black scale. They took kindly to their new quarters, and I hope will increase. We have to breed them in confinement in order to prevent the introduction of a secondary parasite which preys upon them in South Africa. By keeping the secondary parasite out, we can reasonably hope to have as good, or even better, results than they have had in Cape Colony. The other parasite we are now propagating is a very minute chalcid fly that destroys the red scale. This was found in China, and introduced upon a small orange tree by George Compere, a collector of beneficial insects, and special agent of the California State Board of Horticulture. Owing to the "Boxer" trouble in China at the time of Mr. Compere's visit, he experienced great trouble and risk in securing the tree. We have it in a glass case, and the parasites are breeding remarkably well. The scales are more numerous than when the tree arrived from China. This is because we remove the parasites as fast as they breed and send them to infested orchards.

To California belongs the credit of first suggesting the introduction and propagation of beneficial insects for the purpose of benefiting her fruit-growers and farmers.

To California belongs the honor and credit of having furnished the following countries with insects that were of great value to them: Hawaii, Cape Colony, Egypt, Italy, Portugal, Ceylon, Jamaica, Florida, and several islands of the Pacific.

To California belongs the invention of many of the best sprays and washes now in use.

To California belongs the credit of inventing and perfecting methods for the fumigation of orchard trees.

To California belongs the credit of inventing many of the most approved appliances for fighting pests in the orchards.

To California belongs the credit of improved methods of packing and transportation.

To California belongs the credit of protective legislation for the benefit of our great industry, so beneficial in its operations that it has become the model for other States of the Union and other nations of the world.

And above all, and the cause of all our advancement along these lines, California must be credited with the most intelligent, progressive, and advanced horticulturists in the world.

DISCUSSION ON TRANSPORTATION.

HON. R. D. STEPHENS. Mr. Chairman, Ladies and Gentlemen: This is a question with which I have had a great deal to do, and I feel pretty familiar with it. The principles involved are expressed in the report, and I feel that it is important that this Convention should take a very important stand in the matter. I believe the reduction of time is one of the important factors, and I believe as much good to the grower can come from that as from any other one thing. I believe that the improved time we made last year in the shipments of deciduous fruits, although not great, has contributed much to the welfare of the growers in the State. I believe that that alone was instrumental in advancing prices to a very great degree. The reason is that it places the fruit at its destination, at the distributing points in the East, like Chicago, New York, Minneapolis, Boston, Philadelphia, and other places that are growing in importance, at a much earlier period, and it places the fruit there in a condition to be forwarded to places distant two or three hundred miles from those localities, and it will arrive at those places in a condition to be held for a day or two and still be in condition for consumption. Every fruit-grower recognizes that distribution is an important factor. And fruit can not be distributed to a greater degree than in the past unless it arrives in better condition than it has in the past, and you should not lose sight of the fact that refrigeration is still of the great importance it has been in the past. I believe that refrigeration has been the bane of the grower in this State. The immense profits made by refrigeration permitted the interests receiving those profits to eventually control not only distribution, but also the values to a great extent. All the growers ask is that they be placed on an equality one with another. We do not want advantages, but we do want equal rights and equal privileges. There is danger in the fact that the season past has been a prosperous one, comparatively speaking. Because of that fact we might remain nearly dormant and not make any protest against this power, and the railroad companies would then feel justified in renewing contracts with the refrigerator car interests that now have an absolute monopoly of refrigeration. The great influence that was used against Mr. Earl by the other competing interests did not crush him, for he not only owned refrigerator cars, but he controlled a fruit company that was interested in the transportation and selling of fruit. The fact was that Mr. Earl possessed a great advantage over his competitors. That was because he was able to contend against them, notwithstanding the millions at his competitors' backs. Mr. Earl derived all the benefits and profits of refrigeration, while Porter Brothers and the Armour line at that time are presumed to have divided the profits of refrigeration one with another, and it lessened their power, and that is why Mr. Earl was able to contend with these two great powers. Understand, now, that I am not here to make any tirade against any interests. They were thoroughly justified in doing as they did. Any individual here would avail himself of the position should it be offered him. They were in the business to make money and accumulate capital, as we would do if we were doing business in the same way. But it rests with the growers of the State to always look after their interests, and you should endeavor to protect your interests the same as they protect theirs. I am not here to criticise any action taken by them, and if I should criticise any one it would be you growers, because you should look out for your interests better than you do. In continual vigilance on the part of the growers of the State depends their prosperity. You must not expect those whose interests are diametrically opposed to yours to look out for you. We do not want any renewal of those contracts. We want the railroad companies to put on cars and do the business, the same as is done in Washington and Oregon. As I am informed, refrigeration does not cost the growers up there one cent. The maximum is $35 a car. I have a catalogue here showing that they sell Italian prunes in New York at less than an average of 50 cents a crate, and it costs me 54 cents for transportation alone to get them into New York. Of course, under those conditions, we can not compete with Washington and Oregon fruit. We do not want their rates raised, but we do want ours lowered, so as to put us on an equal basis with the growers of those States. Mr. Earl said he did not want to remain in the refrigeration business, because he had a fruit company. It is claimed that the Armour Company is not interested in the marketing of fruit, and yet there is the strongest circumstantial evidence in the world that it is interested. Now, suppose they should get a renewal of the contracts, is there any law against a man selling his stock which he may hold in a corporation? Is there any law against a party buying it, and might it not be an easy thing for them to come into possession of the stock of the Earl Fruit Company? I believe that every person who invests capital in any interest should be entitled to a fair compensation, that is, if the interest is legitimate. But I want them to permit the growers to also receive a reasonable interest upon the capital that they have invested in agricultural interests in this State. You may take a car; they claim now that the cost is $1,000, though possibly about $800. What is a fair interest on $800. Allow them ten per cent, and what have you got? It is $80 for the year. But that is nothing in comparison with what they make. In talking with a refrigerator car man the other day, I said the growers should be allowed to make a fair interest on capital invested and the labor. "No, sir," said he, "they ought not consider interest on the capital invested." He said that was invested in real estate, and they ought not to consider that they were entitled to interest on capital invested in that way. He said the car was a perishable article. I would like to see the growers and the refrigerator car lines go into partnership to this degree, that each should be allowed the same per cent or interest on the capital invested. If you would allow the growers in California to receive an equal per cent for the capital invested I think they would be perfectly satisfied to maintain rates as they are now, because their income would be pretty good. I feel that that proposition would be rejected, because they have a good thing and would not enter into such an agreement with the growers. They say arbitrarily that they must have so much, and that is all there is about it. The fruit-growers are to a great degree masters of the situation, however, if they only knew it. You will see from the memorial which was presented to the railroads, and which comprises but a limited part of the correspondence that took place between the officials of the railroads and your committee, that they realize that the growers of California are a unit, and this is the first time they ever recognized that thing. Prior to this time the committee had appeared before the officials in a body and said, "We want a reduction," etc., and the officials said, "We will take it under advisement," and that was generally the end of it. But in this case the committee constantly and continually, without an intermission of six days, endeavored to support the resolution passed by this Convention one year ago in the advocacy of the reduction of time. The railroads at last seemed to realize that the fruit-growers were organized and were getting to be an important factor. Then they were willing to grant our request, as was expressed in a letter from Mr. Sproule on the 21st of May last, and we will derive a benefit from the reduction that was made. We not only want the time that was given by the road, but that they comply with their contract made on the 21st day of May, 1901. If they will carry that out you will find in your returns that you will get better prices and greater profits, that it will broaden the markets, and that our fruit will be distributed to better advantage.

I move that this report be received and placed on file, and that the sentiments therein expressed be adopted by this Convention.

Motion carried.

MR. A. N. JUDD. I went up to Washington and Oregon to study the fruit business, as I am engaged in it at Watsonville. I found that every point where a car or two of fruit were to be shipped was a terminal point, and at points where they were paying 60 to 75 cents a hundred on apples, I found that we were paying $1.05. Refrigeration charges, instead of being $35, were $10 to $17.50, and no extra charge for icing en route. They shipped 30,000 chests of strawberries last year from the Hood River, and are planting trees in that section to increase their orchard areas 300 to 500 per cent. Their prunes were selling readily at 4, 5, 6, and 7 cents. One grower, when he learned I came from California, chuckled at the differences among the Santa Clara growers, and remarked, "You are making a market for our prunes right along. You are simply holding an umbrella over our heads. We will get all the benefits if you keep quarreling among yourselves." The State Horticultural Commissions of both Washington and Oregon are well supplied with money, and in the essentials of successful fruit-growing are far ahead of us. They are shipping apples to-day to Manila, Hongkong, and Vladivostok, and have two or three agents in several of the Trans-Pacific countries constantly making markets. Before long we will be up against a hard proposition in this matter of rates. I move you, sir, that the same Committee on Transportation be appointed for next year, that they shall report at the next annual convention, and that their investigations shall cover these matters of difference in the rates in California with those of Oregon and Washington, and all other things necessary to give the fruit-growers of California a clear idea on those matters.

Motion carried.

On motion of W. H. AIKEN, the Committee on Transportation was made perpetual, and those who will compose it were left to the choice of the Chairman, who selected R. D. Stephens of Sacramento, Alden Anderson of Suisun, A. H. Naftzger of Los Angeles, and A. N. Judd of Watsonville. The fifth member is to be appointed later.

The Convention then adjourned until 1:30 o'clock P. M.

AFTERNOON SESSION—FOURTH DAY.

FRIDAY, December 6, 1901.

The Convention met, as per adjournment, at 1:30 o'clock P. M. President COOPER in the chair.

FOOD ADULTERATION.

BY PROF. M. E. JAFFA, OF THE UNIVERSITY OF CALIFORNIA.

The subject of this afternoon's discussion is one that should be interesting to all people, not only from the purely educational standpoint, but on account of its practical application to our every-day life. We are all more or less affected by food adulterations, and, whether we know it or not, are to a greater or less degree the victims of fraudulent practices. There have been efforts made by the governments of all countries to limit, if not to wholly eradicate, this evil. But until the people themselves really desire and demand pure food, the government alone can do comparatively little. Laws may be enacted, but they will not be enforced, unless there is some degree of interest taken in them by the people at large. Food laboratories may be established as they are at present, and experts paid to examine foods, but ninety per cent of the people will go on in the same old way, utterly regardless of the investigations, continuing to buy articles condemned by these experts, when a better and purer substance may perhaps be had at the same dealers for the same price. And it is partly with the object of making a plea for the establishment and maintenance of well-equipped food laboratories and for their hearty support by the public that this paper is presented here to-day. The question of food upon which we all depend for our lives, to say nothing of our health and strength, is too important a matter for any one to neglect. And every good citizen should acquaint himself, as fully as possible, with this subject, so as to assist, so far as lies in his power, in the passage of such laws as will insure the utmost honesty in the handling of our foods.

The adulteration of foods is not of modern origin. We have evidence of such practices among the ancient Greeks and Romans. In Rome, bread was sometimes made from flour mixed with a white earth. The adulteration of wine in Athens necessitated the appointment of a special inspector, whose duty it was to detect and stop these sophistications. Greek history has handed down the name of Canthare, who excelled in ingenious mixtures, and knew how to impart the flavors of age and maturity to new wines. His ingenuity was such, that it was commemorated in the proverb, "Artificial as Canthare."

In Rome, also, wine was much tampered with; even the rich, according to Pliny, could not obtain the natural wines of Palermo, for they were adulterated in the cellars; and certain wines from Gaul had an artificial color given them by means of aloes and other drugs. That kind of wine is still a popular drink in some parts of Spain—as Valencia.

In England and in Europe generally from the eleventh century onwards, the different tradespeople, particularly, bakers, brewers, and dealers in spices, were accused of corrupt practices.

In England and France the first laws regulating the sale of bread were passed at the beginning of the thirteenth century. The original object was to regulate the price of bread by limiting the profit of the baker on each cental of wheat, so that the price of each loaf should bear a certain proportion to the price of the cental of wheat. There were various modifications of these assays, and they were finally abolished in 1815. In 1266 a law was in force forbidding the sale of unwholesome meat and wine. This law remained active until the middle of the seventeenth century.

In the sixteenth century *ale-tasters* were appointed, whose duty it was to "try, taste, and assize" all beer before it was sold. They had one very peculiar and crude method of testing for adulteration with sugar, which was probably more convincing to the laity than our present more scientific laboratory methods. The ale-taster poured some of the ale upon a wooden bench, and then sat down upon the spot, attired in leathern breeches; if he, later, experienced any difficulty in rising from the bench the ale was pronounced "adulterated," but if the dried extract had no adhesive property, and rising was easy, the ale was pronounced "pure."

Cases of dishonest tampering with food were severely dealt with in England during the middle ages, the offenders being subjected to corporal punishment and exposure in the pillory.

In Germany there were many regulations in regard to bread, wine, beer, and drugs. There is a case on record of a dealer in Biebrich who was convicted of selling adulterated wine. He was sentenced to drink six quarts of his own mixture. He did so, and died from the effects.

Up to the middle of the present century but little progress was made in reducing the extent of adulterations, the practice increasing rather than decreasing. The establishment, however, of the Lancet's Analytical Sanitary Commission in 1850, with Dr. Arthur Hill as analyst, and Dr. Hassall as leading spirit, marks a new and most important era in this work. This commission was the first to undertake any systematic investigations along this line; but this example was soon followed by other countries.

The Analytical Sanitary Commission was commenced in the first number of the Lancet in 1851, in which the editor states: "We propose, for the public benefit, to institute an extensive and somewhat rigorous series of investigations into the present conditions of the various articles of diet supplied to the inhabitants of this great metropolis and vicinity. * * * Special features of the inquiry will be that they are all based upon actual inquiry and experiment. The microscope and test-tube will be our constant companions."

This was the first instance of any extensive application of quantitative analysis and of the microscope to the examination of foods. The work of the commission was carried on for four years, and was productive of excellent results—one of which was the appointment of "The Select Committee on the Adulterations of Foods," which is still in existence; another, the passage of the first general act in 1860, which was followed by many others, the last being enacted in 1887.

Actually the work of the commission met with opposition in every form, particularly from dealers and manufacturers. Even in Parliament, Sir Charles Wood, Chancellor of the Exchequer, quoted as opinion of the "most distinguished chemist of the day" the assertion that "neither by chemistry nor by any other means could chicory be detected in a mixture of that substance with coffee." With the aid of the microscope Dr. Hassall proved this assertion to be false.

The English law on this subject has exerted a powerful and wide influence. In framing all subsequent laws in other countries the English law has been carefully studied, and the experience gained in thirty years' contest between friends and foes of pure-food legislation has saved lots of time and misspent effort. It might well be asked why, after all these years of recognition of this evil, have we not done more toward overcoming or regulating it? But, as Hon. Marriot Brosius of Pennsylvania says: "We are a peculiar people—man is not only a bundle of habits, but the parts of his character are in a state of chronic war with each other."

Is it any wonder that no one has been able to find a suitable definition for him. Bryant says, "Some define man as a talking animal, overlooking poor Poll. Some have defined him as a laughing animal, forgetting the laughing hyena; others as the animal that cooks food, not thinking of the traditional monkey that used a cat's paw to pull the chestnuts out of the fire. Seeking thoughtfully for a definition drawn from a wide generalization, I have come," he says, "to the deliberate conclusion that the only definition which sufficiently determines and distinguishes man from all known animals is this, 'man is an animal that *adulterates* and sometimes *poisons* his own food and drink.'"

Let us see how he does this. There are two different methods employed. First, the harmful and sometimes poisonous to the human system; and second, the deceptive and fraudulent, but not injurious to the health of the consumer.

The first class is the more important for us to consider. The materials used as adulterants act as preservatives or antiseptics. These are added to the foods or food products for the purpose of killing germ life or arresting and inhibiting fermentation. Those that are more commonly used are: Salicylic acid; boracic acid, or borax; sulphurous acid; formalin.

Before discussing these compounds in their relation to food, it seems pertinent to inquire into their effect on digestion.

Digestion, whether it be salivary, gastric, or pancreatic, is a process of fermentation due to the soluble enzymes present in the different liquids; consequently, any compound that will prevent fermentation will hinder digestion. All chemical agents which precipitate pepsin arrest digestion, and generally the salts of the heavy metals exert this action, as lead acetate, copper sulphate, mercuric chloride, alum, etc. Neutral salts of the alkalies and alkaline works, as $NaCl$, Na_2SO_4, $MgSO_4$, and Kl, hinder peptic digestion. Sulphurous acid arrests it. Dr. Allan states: "The changes by which native proteids are split up, with successive formation of soluble and diffusible products, commence in the stomach, continue in the duodenum, and are completed in the small intestine." These changes are apt to be retarded or entirely prevented by the presence of certain drugs and other foreign matter, such as coloring matter and antiseptics or food preservatives. Hence, the influence of such bodies in the processes of digestion and assimilation is a matter of considerable practical importance. When present in excessive quantity such additions can hardly fail to retard and interfere with digestive action; but the effect of the small proportions generally employed is less certain, and very little authentic information exists on the subject. But we must never forget that there is the accumulative action of drugs when very small quantities are employed for a long time.

The Select Committee on Food Adulteration, which sat during the sessions of 1894, '95, and '96, reported that in their opinion the use of antiseptics in food is one which deserves further investigation, by recognized scientific authorities, with a view to an expression of an opinion that would be regarded as authoritative. The editor of the Lancet accordingly addressed letters to various leading members of the medical profession, asking the following questions:

First—Is the presence of salicylic, boracic, or benzoic acid or of formalin in food, in quantities sufficient to preserve it, injurious to health?

Second—Should the use of antiseptics for this purpose be forbidden by law altogether?

Third—Should legislation be brought to bear on the restriction of the amount?

Fourth—Should the law insist that when preservatives are used the fact should be stated on the labels?

The answers to the above questions were published in the Lancet for 1897, page 56, *et seq.*

Sir Henry Thompson holds that the addition of antiseptics was undesirable, though unable to produce evidence that any of them had given rise to deleterious action; owing to the impossibility of isolating the precise influence of the drug. He objects strongly to the dietetic use of drugs, and is of the opinion that the name and quantity of the antiseptic employed should be on the label, etc.

Dr. Pavy does not consider our knowledge sufficiently extended to permit of its being taken for granted that no injury is producible, though there is no evidence of injury to health. He points out that it is the vendor and not the consumer who is benefited. He considers that notification of the fact of antiseptics being employed and their nature and amount would be sufficient. With the public interest thus safeguarded he thinks that advantage might be taken of the power of antiseptics in preserving articles of food.

Dr. F. J. Allan points out the possibility of daily accumulation of antiseptics quite sufficient to produce a gradual lowering of the standard of health; and is of the opinion that the fact of an antiseptic being added, and its nature, should be required, by law, to be announced at the time of sale.

Dr. Sims Woodhead draws attention to the idiosyncrasy and cumulative effect, and dwells upon our ignorance of the action of certain drugs (formalin) on foodstuffs. He points out that by the use of preservatives foods of inferior quality may be doctored. He would make the use of antiseptics illegal, unless their nature and quantity be made known.

Dr. T. L. Brunton writes that we must remember that poisons are formed in food by spontaneous decomposition, which may take place after purchase. The question to be decided comes to be whether antiseptics are likely to be more injurious to health than the natural products of decomposition. (I do not consider this point well taken. There should be no necessity of choosing between antiseptics and food poisons. Our food should be fresh and in such good condition that there should be no opportunity for spontaneous decomposition.) His own belief is that preservatives are less injurious, and the answers are: 1. The use of antiseptics should not be forbidden by law; 2. It is doubtful whether legislation should restrict the amount, as manufacturers will probably use the minimum amount found sufficient; 3. The fact of preservatives being used and their amount should be stated on the label.

Dr. J. B. Bradbury thinks that it is not necessary to forbid the use of antiseptics, but that either the amount should be restricted, or the fact of their addition stated on the label.

Dr. Whitlegge can not speak positively, though it is clear to him that the law should insist on a plain statement on the label if any preservative was added.

The late Sir B. W. Richardson considered that antiseptics are not only necessary at this moment, but when used in proper form and quantity cause no injury whatever (a very bold statement). There ought to be a license given permitting a certain fixed and not dangerous quantity of antiseptics, and it ought to be stated on the label what the antiseptic is and its quantity.

Dr. Chittendon has shown that permanganate of potash, borax, alum, sodium salicylate, quinine, and salts of alkaloids act antagonistically to peptic digestion.

In the light of the above evidence from such distinguished men, is it any wonder that the layman is puzzled? Should we blame or consider the manufacturer so reprehensible if he used or advocates the use of antiseptics?

The keynote of the foregoing is: that we know very little of the use of these preservative agents, and that physiological investigations are urgently called for. But in view of our insufficient knowledge, and until we do have authentic data, would it not be more advisable and erring on the safe side to prohibit the use of such drugs?

Professor Hilgard states, "There is far too much at stake not to deserve the utmost conservatism and distrust of departure from what for thousands of years has, by the universal consensus of opinion, been proved to be a safe criterion of the healthfulness of food: *to permit in it nothing that is not naturally an ingredient either of food itself or of the human body.*"

I devote considerable time to the antiseptics, not because adulteration by these is the most extensive—quite the reverse—(only about ten per cent of the total sophistication is due to treatment with these chemicals), but because they are of more vital interest, as they are generally present in foods used by persons of weak digestion or by invalids whose digestive systems are over-sensitive, and therefore more readily acted on by drugs. Doctors often recommend for very young children and invalids "unfermented grape juice." Several brands are on the market in California and in the East, each and all claiming to be absolutely pure and free from antiseptics. With one or two exceptions they have, upon examination, showed the presence of notable quantities of salicylic acid. Some of these samples have been procured from "pure-food exhibits."

Salicylic acid is often found in wine, and when you find a bottle of white wine or claret that, after being opened, will not "sour" upon standing for a few days, you can rest assured that either salicylic acid or some other preservative has been added. Jellies, preserves, and canned goods are adulterated in some instances with this chemical, thus preventing mould or fermentation. Vendors have sold, and are probably now selling, to rural housekeepers tablets under the name of "Extract of Salyx," "Preservaline," etc. These have, upon analysis, proved to be salicylic acid with some harmless filler. Now there is no doubt whatever that they will do the promised work, but if persons wish to use such a preservative it is far cheaper to buy from a druggist salicylic acid at $2 a pound than to buy the tablets or lozenges at the rate of $16 per pound.

Another compound, called "Preservitos," has been examined by the Cornell Station—a white powder dissolving readily in water. The directions are: "Add ½ to 1 oz. of preservitos to each gallon of cream, according to length of time it is desired to keep fresh. The smaller proportion will keep cream sweet and with full flavor for a fortnight, and the larger proportion for a month, if the cream is quite fresh at the time of addition. It is advisable to make a paste of the preservitos with a little cream, and then add the paste to the bulk of the cream." Analysis showed: 30 per cent borax and small proportion of salicylic acid, and 60 per cent sugar. 1 oz. = 1750 grains = 600 grains borax, *without* the salicylic acid. This must have a decidedly injurious action on digestion.

Two or three pamphlets lately published in the interest of the borax industry contain results of many experiments in digestion, some *artificial*, some on dogs as subjects. In case of the artificial experiments, it appears that borax is not a hindrance, but a help to the digestion of albuminoids. But it does, even in small doses, interfere with amylolytic fermentation, much of which takes place in the small intestine. And even if digestion in the case of the dog was not embarrassed by the addition of borax, it does not follow that in the human system like conditions would obtain—our food containing much starch, that of the dog practically none.

The practice of sulphuring fruits just previous to drying is carried on to almost an alarming extent. A slight sulphuring of the fruit would in all probability not be injurious. But the heavy sulphuring, one might say, heroic treatment, that is meted out to the dried fruits in some parts of the State can only result deleteriously to the fruit and tend to injure the health of the consumer. In Germany two years ago consignments of dried apricots were subjected to analysis and found to contain a notable percentage of sulphur compounds. The sale of such fruits is, in Germany, in direct violation of the law. The attention of

American shippers was called to this condition of affairs and to the absolute necessity of abstaining from the use of sulphur. Persistence in this practice will undoubtedly result in the entire exclusion of such fruits from Germany. Probably, though, in this country, the practice will not decrease while the demand for "the finest appearing" fruit exceeds that for the more wholesome. But while the bleaching of thoroughly ripe fruit is to be deprecated in the strongest terms, still such methods sink into insignificance when compared to those adopted by unscrupulous persons who sulphur, and heavily too, *unripe*, immature apples and pears so as to render them, under our present system, marketable. Desiccated vegetables have been bleached to such an extent that acid can be tasted when the material is moistened.

One of the most efficacious food preservatives is formalin (H_2CO) or formaldehyde, discovered in 1867 by Von Hoffman. Its antiseptic properties were not discovered until 1888–1890. This agent is more effective than boracic acid, borax, salicylic or benzoic acids. It is a germicide, preventing putrefaction, and kills all ferments. One tablespoonful to one quart equals one per cent solution. As further evidence of the power of this agent, it might be said that "the behavior," in the Babcock test, of milk which had been preserved by formalin, shows that its composition is in some way affected. Ordinarily, the curd of milk is dissolved by the sulphuric acid that is used in the test. Where formalin is present the curd often fails to dissolve, and becomes a compact mass. If the preservative can so alter milk that H_2SO_4 may fail to dissolve the curd, it is not the least likely that the action of the digestive juices may be rendered less effective. Formalin itself is volatile, and hence some say that if the foods preserved with this antiseptic are cooked formalin will be volatilized. True enough; but what about the ingredients that have been acted on? It is claimed that even gelatin exposed to formalin vapors is rendered insoluble, even in hot water or in alkaline solutions.

If, however, in the light of the facts just set forth, a person should wish to preserve foods by means of formalin, he should buy it as such, for about sixty cents per pound, and not purchase a solution called callerine. This preparation, put up in Philadelphia, was put on the market with labels setting forth its properties, which were identical with those attributed to formalin. Among the directions were: For milk, one ounce (two tablespoons) callerine to fourteen gallons of milk, will keep it at a temperature of 75° F.; for longer period, use more callerine. A solution of two ounces of callerine to one quart of water will be an efficient wash for preserving meat, poultry, game, fish, vegetables, etc. Price, $6 per gallon, or $1.25 per pound for a working sample.

Upon examination at the Cornell station this material proved to be a seven per cent solution of formalin.

1 gal. Formalin, weight 9 lbs., at 60 cents	$5 40
$5\frac{5}{7}$ gals. Callerine (equal to 1 gal. Formalin)	34 28
	$28 88

1 lb. Formalin	$0 60
$5\frac{5}{7}$ lbs. Callerine (equal to 1 lb. Formalin)	7 14
	$6 54

The above figures show the profit made by vendors of this preparation.

One of the most salient objections to the use of nearly all of these antiseptics can be formulated on the ground that their presence in any food or food products can not be directly detected by the consumer, but only by means of expert chemical analysis. A constant use, however, would undoubtedly manifest itself by derangement of some part of the digestive system.

THE SECOND CLASS OF ADULTERANTS, OR DECEPTIVES, comprises between eighty and ninety per cent of the total food adulterations. On the border line between the two kinds are perhaps the *Baking Powders*. Three different kinds are recognized:

1. Tartrate powders, in which the acid constituent is tartaric acid in some form.
2. Phosphate powders, in which the acid is phosphoric acid.
3. Alum powders, in which the acid is sulphuric acid contained in some form of alum salt.

The alum powders would seem, according to the latest data, to belong in our first class of adulterants, as will be seen by the words of Professor Prescott: "Alum acts on the mucous membrane as an irritative astringent. It lessens the digestibility of albuminous foods. In medicine it is used with caution, locally and not continuously. In food it should never be used. Mixed with carbonated alkalies in baking powders, the resulting hydrate of aluminium is in part soluble in the acidulous liquid needful to digestion when the effects of alum are obtained. Besides, it is unsafe to depend upon the completed action of the soda and its exact chemical proportions in the baking powder. There should be just sufficient so that the whole of the aluminium be converted to a hydrate, and any excess of the soda is detrimental. The use of alum has always been forbidden. It would be proper that its use in baking powder should be prohibited by law, as is the case in England and France."

The continued consumption, however, of any of the baking powders would overload the system with mineral matter.

If the tartrate powders are mixed with flour or starch as fillers they come under the head of deceptives, as tartrate powders rationally used are not supposed to be injurious to the health of the average man.

The *jellies* are good examples of deceptives. For instance, if currant jelly is mixed with apple, a fraud is perpetrated on the consumer. But as far as health is concerned one is as nourishing as the other, and the compound far from injurious. When, however, gelatin, starch, etc., are added, then it is a pecuniary cheat, for we do not obtain the amount of nutriment paid for.

Honey is one of the products very often found impure in the market, especially in the liquid state. Liquid glucose has been in many cases mixed with honey. It is the very thing to add, and if pure is so harmless that it is no wonder that it is the main sophistication. Chemists can much easier detect that than the addition of inverted sugar. The same result is obtained whether the bees are fed inverted cane sugar or whether the bees eat cane sugar and invert it themselves.

Condiments are probably the most generally adulterated of all food products. About fifty per cent are found impure in the market, the materials used being wheat flour and wheat products, sand, brick dust, cocoanut shells, almond shells, rice, middlings, etc. These materials, with the exception of sand and brick dust, are perfectly harmless, but the incorporation of them into spices is a fraud.

Coffee adulterants consist of preparations of wheat, rye, barley, peas, chicory, etc. Sometimes artificial beans are manufactured from green clay and some genuine coffee. These beans, on being heated, assume the tint of real coffee beans, because the green clay absorbs the coloring matter of the genuine coffee, thus imparting to the whole a normal tint.

Tea. In 1887 Dr. Spencer, after examining sixty-three samples of tea purchased in Washington, D. C., arrived at the conclusion that there are few if any spurious teas on the market. The main adulteration practiced in the case of tea is "facing," that is, coloring the leaves which for some reason or other have been damaged in manufacture or otherwise, to improve their appearance. The Chinese and Japanese do not face the teas they consume at home; only those intended for export are so treated. Materials employed are Prussian blue, turmeric, indigo, and plumbago. Prussian blue is insoluble in water or alcohol—it is deemed a tonic febrifuge, etc., but at present rarely used. The dose is from two tenths to three tenths of a gram per day. One would have to consume a pound of tea to absorb that much Prussian blue. Similarly regarding the adulterants mentioned above. "Spent" tea is a form which one sometimes finds in the market. It is nothing more or less than tea which has been once used, dried and repacked.

Salad Oils, which should consist entirely of olive oil, are largely adulterated, chiefly with cottonseed, mustard, and sunflower oils, and to a less extent with several others, such as lard, rapeseed, maize or corn, poppyseed, etc. Sunflower oil makes an excellent salad dressing, and hygienically is perhaps as good as olive oil; but the fraud consists in selling the sunflower or cottonseed oil at the same price as olive oil. It is claimed that cottonseed oil clogs the system.

Flours. Very little, if any, of the white flours of the Pacific Coast are spurious. Not so in the East, however, where corn products are employed as fillers, and in the old country clay and gypsum.

Gluten flour is a material which, while not adulterated, is not always what the label represents it to be. This meal is recommended by physicians for individuals suffering from diabetes, on the supposition that such flour will contain the minimum amount of starch. Many samples have been analyzed by our Station, with the result that very few are entitled to the name gluten flour. The majority of the specimens examined rated in starch content but little below that of a first-class whole-wheat meal; the cost, however, ranged much higher. Here we have a double fraud. In the first place, the patient is consuming a greater proportion of starch than is advisable; and secondly, the outlay is from three to five times what it should be. If a person asks for a forty per cent gluten flour and receives an article only yielding fifteen per cent, the deception is apparent. Then again, when a gluten flour is desired, perhaps a large percentage of bran is obtained. We have another case of imposition, and a good illustration of the fact that chemical analysis alone is not a sufficient guide to the physiological or nutritive value of a food. The digestive coefficient of the protein or albuminoids in a gluten flour is far higher than that for a meal, showing a high percentage of bran, although the percentage of protein in both cases may be identical.

Butter. From the first day of January, 1894, to March, 1895, 450,000 pounds of oleomargarine were sold in this State; of this, 300,000 pounds were manufactured in the State and 150,000 pounds imported. The unlimited sale of the oleomargarine resulted in a loss to the dairy industry of over $100,000. Since the passage of the law in 1895 for the prevention of deception in the manufacture and sale of butter and cheese, very little has been sold. Oleo is the chief ingredient in spurious butter, and the presence is easily ascertained by the expert chemist. Owing to this fact, and the expense attending the establishing of a plant for the manufacture of oleo, but little of this imitation butter is found on the market. (Oleo is sterilized fat from the beef, strained and pressed, stearine remaining behind; and the liquid = oleo neutral oil made from lard as above, except that no stearine is extracted.)

The nutritive value of good oleomargarine is fully equal to that of good butter, and without doubt will keep fresh for a much longer time.

In cases of a delicate stomach the advantage, however, will be on the side of butter.

Butter-increasers are the names given to several compounds sold throughout the East, but not to any extent in California. Chase's Butter-Increaser is a solution which, according to the label, is capable of doubling the yield of butter from cream, if added in small proportions to the cream before churning. It is a twenty-five per cent solution of acetic acid and small amount of salicylic acid. The acetic acid curdled the casein and incorporated it in the fat, thus doubling the weight of the product, which was not a good butter nor even a poor cheese.

Another nostrum is a powder called "Gilt Edge Butter Compound." It guarantees to make two pounds of butter from one pound of butter and a quart of sweet milk. Directions: Warm the butter until soft; mix in the milk, and add as much of the compound as could be placed on a one-cent piece. The resulting butter (?) will weigh two pounds. The compound is alum and soda and a little pink coloring-matter. Same action as that of Chase's Butter-Increaser.

Cheese. Previous to the passage of the cheese law in 1897, the honest cheese-manufacturer had no redress against the dishonest. Now it is entirely different. Both the consumer and the seller are better protected. Each cheese must be branded as to its kind, whether full-cream, half-skim, or skim-milk cheese. Very little filled cheese is to-day to be found in the market, for reasons similar to those stated for butter.

Filled cheese is cheese in which the fat is oleo or neutral oil, and not butter fat. Skim milk and oleo are the materials from which is produced filled cheese. This product is put up in exceedingly neat packages, presenting a very attractive appearance. It is more homogeneous as a rule than cream cheese, will keep for a longer period of time in better condition, and little can be said against its nutritive properties. At the same time it is a rank fraud, if sold under any other label.

An exemplification of a gross imposition is shown in the substitution, by some candy-manufacturers, of apricot kernels for almonds.

Many more examples of deceptives might be cited to show how much such sophistication is in existence, but for such a discussion the foregoing is amply sufficient.

Another form of deception is noted with reference to some of the proprietary foods—not in the foods themselves, but in the labels. These convey to the mind of the laity, in many instances, decidedly wrong impressions. Just one illustration: "Grape-Nuts." This food is made by special treatment of entire wheat and barley, and has nearly the same proximate composition as the wheat foods. Part of the starch has been changed into dextrine and grape sugar. The claims of the makers are preposterous: "Grape-nuts are a condensed food." "Four heaping teaspoonfuls are sufficient for the average meal." "The system will absorb a greater amount of nourishment from one pound of grape-nuts than from ten pounds of meat, wheat, oats, or bread." A man at moderate work needs per day about .28 of a pound (4½ ounces) of protein, and sufficient fats and carbohydrates to make the potential energy 3,500 calories. Four heaping teaspoonfuls of grape-nuts weigh one ounce. The protein and energy needed for one meal (one third of one day) and that furnished by four heaping teaspoonfuls of grape-nuts are compared in the following table:

	Protein. (lbs.)	Fuel Value. (calories)
Needed for one third day by man at moderate work	.090	1,175
Furnished by 4 heaping teaspoonfuls (1 oz. grape-nuts)	.007	117

It would require .77 of a pound of grape-nuts (three fourths of a package) to furnish one third of the protein needed for one day, and the energy needed would be afforded by .63 of a pound.

The nutrients of beef are usually more completely digested and absorbed than those of vegetable foods. There is no reason for thinking that grape-nuts would be more completely digested than rolled oats, wheat flour, or wheat bread.

In the following table there are compared the pounds of protein and fuel values of one pound of grape-nuts, with ten pounds of meat, wheat, oats, or bread:

	Protein. (lbs.)	Fuel Value. (calories)
1 pound grape-nuts	.12	1,870
10 pounds round steak and bone	1.90	8,950
10 pounds beef rump and bone	1.29	14,050
10 pounds rolled wheat	1.30	17,650
10 pounds flour, white	1.01	16,450
10 pounds rolled oats	1.50	19,650
10 pounds white bread	.80	12,200

While there is no question that grape-nuts is a good cereal food, it is difficult to understand why the manufacturers should make claims so absurd and contrary to fact.

And now for just one moment let us consider why all this goes on. We have laws against these practices. In our own country nearly all the States and Territories have laws on this subject, but they are not rigidly enforced. Determined efforts have been and are being made to secure a national food law, and it is to be hoped that we shall not have many years to wait for it. But the mere passage of the law will not accomplish the work. We must grow up to the law as individuals and as a people. Law alone will not effect it. Pure-food conventions alone will not do so, nor will pure-food exhibits. All these help, but they accomplish but little, so long as the more enlightened and better class of people do not take an active part or display sufficient interest in public affairs, and so long as the municipal offices are in control of men mentally or morally unfit to assume the responsibility. *When* the public is properly educated on the subject, and people begin to desire pure food furnished to them in its best form, *then* will food laboratories be established and properly maintained; *then* will food laws be strictly enforced and food adulteration become a practice of the past.

Upon motion, the paper by Professor Jaffa was received and placed on file.

SELECTION OF THE NEXT MEETING-PLACE OF THE CONVENTION.

The following places were placed in nomination: Oroville, Butte County; Hanford, Kings County, and Los Angeles; resulting in Hanford receiving nine votes, Oroville three, and Los Angeles seven.

The Chair then called for a vote from those who wished to leave the matter of selecting a place to the State Board entirely, and suggesting the city of San Francisco, and seventeen votes were cast.

Upon motion of W. H. Aiken, the matter of selecting the next meeting-place was left with the State Board of Horticulture.

The following were appointed a committee to judge the fruits exhibited before the Convention, and were ordered to report to the Secretary of the State Board of Horticulture: Edward Berwick, Edward Ehrhorn, and Professor George Hussmann.

Edward Berwick, E. F. Adams, and B. N. Rowley were appointed a Committee on the Nicaragua Canal.

BIRDS IN THEIR RELATION TO AGRICULTURE AND HORTICULTURE.

By W. OTTO EMERSON, of Haywards.

The beneficial relations of birds to agriculture and horticulture are of untold value, not easily expressed by figures of speech. We find in this age of rapid advancement in the modes of producing the best results from the soil, that man strives in every way to protect his holdings. This is as it should be, and shows his desire for increased knowledge and his elevation to a higher plane in this world's affairs.

After years of careful research, it has been proven that bird life has certain functions to perform in guarding the food-supply of the earth, just as the hills carry the falling rain down to the lower levels, and as the grass-blades and leaves protect the seeds, blossoms, and fruits against damage.

If it were not for our feathered tenants about us, our existence would be only for a few short months of hard battling against the hordes of insect pests.

We have two great classes of the Avis family—water and land birds. The former I shall not refer to at present, as they do not especially interest the farmer or fruit-grower; but as to the latter class, we will see what part they play in the conditions of our existence.

We can divide the land birds into many groups, such as carnivorous, insectivorous or partly so, and granivorous, wholly or in part. It is only within the last ten or twelve years that any attention has been given to the investigation of bird foods at the hands of ornithologists, particularly those connected with the Department of Agriculture.

One of these groups of birds that should have more care given them are the raptores, or birds of prey. Of the hawks and owls, of which we have some ninety varieties distributed over the United States, we find seventeen of the hawks throughout our State, besides ten varieties of owls. Of the hawks, only two species have proven harmful to the farmer's interest. These are commonly known by the name of Cooper's and Sharp-shinned hawks, both feeding on small birds and game.

Cooper's hawk is of a dark brown color, excepting under-parts of body, which are white, having markings of brown in long dashes; eyes and legs, yellow; tail having broad bars or bands of grayish white; both sexes being similar; length of bird, 16 inches.

The sharp-shinned hawk is of a reddish-brown or slate color on the back and wings; breast of light-reddish color, barred across with markings of the same color, but darker. Tail, banded; eyes and legs, yellow; legs slender and very long; length of bird, 10 inches.

In referring to Bulletin No. 3 on Hawks and Owls, by Dr. A. K. Fisher, U. S. Department of Agriculture, we find that out of 2,212 stomachs examined, only 3½ per cent contained poultry and game, while 56 per cent had mice and other mammals, and 27 per cent showed that the food consisted of insects. In these analyses of the stomachs of hawks and owls it will be seen that a large number of rodents are destroyed, resulting in the farmer's welfare.

One of our most common raptores, known as hen-hawk, and at whose door is laid all the charges of chicken-stealing, is the Western red-tailed hawk (*Buteo borealis*). It can be seen almost any day the year round circling over the hills and valleys, or on watch for some unguarded squirrel, of which they are great hunters. Mice and grasshoppers make up much of their diet, the birds' crops being often packed with them. A specimen which I shot in February contained five mice. This species of hawk has two plumages: Adult, dark brown over back; wings and tail barred with same; under-parts and the entire breast a rufous-brown, spotted with a darker shade of the same color.

The young of the year are without any of the rufous under-parts, and are dashed only with dark brown.

In some States bounty laws have been passed for the scalps of hawks and owls. Pennsylvania, in 1885, passed such an act, which cost her in just nine months the sum of $90,000. Now compare this with the aggregate amount of damage done to crops by rodents and insects in that same State annually, which is about $5,000,000. This may seem a large sum, but is only a drop to what other States have suffered, such as Illinois, which lost $73,000,000 in 1864 by the ravages of the chinch-bug. Missouri, by the same bug, in 1874, lost $19,000,000.

Other useful hawks we have in our State are Swainson's, the red-bellied, and the little falcon, known as the desert sparrowhawk. This latter species is often blamed for the depredations of the sharp-skinned hawk. The sparrowhawk feeds entirely on insects, such as beetles, grasshoppers, mole crickets, field mice, and lizards. Its favorite look-out is from any fence-post or a cross bar of a telegraph pole. They can be easily recognized from other small hawks by (male) dark, slate-colored wings, a hood of the same color, with a crown of chestnut-red; the whole back barred with black; breast, reddish-white, striped or spotted with black; tail barred with same colors. The female is chestnut-brown on back and wings, lighter on breast, barred with a darker color; tail, the same. Both sexes have white cheeks and a black mark running down from the front and back of the eye. Legs, yellow.

A few words as to the benefits derived from the owls (*Strigidæ*) by the farmer and orchardist. The barn owl takes precedence, as being most beneficial about the orchard, field, or farm buildings. They will destroy more rodents in one night's hunt than a dozen cats; six mice and two or three gophers being a small bag for one owl and its brood. Gophers go largely to make up their diet, and it is not uncommon to find five or six in their nesting or roosting places in hollow tree limbs or even in holes in steep banks. The general color of the barn owl is ocherous-yellow, more or less speckled or marbled with black. The eyes are black, and the feet are feathered to the toes.

One of the smaller, cat-like owls, known as the California screech owl, of mottled gray and black, spends much of its time among the orchard trees and stubs catching great numbers of small mammals, crickets, beetles, and other insects. Out of 255 stomachs examined of this little *Scops*, 91 contained mice, 100 had insects, and 43 were empty, showing the amount of good they do among our trees.

Other species of owls beneficial are the burrowing owl, short-eared and long-eared owls. The former is seen about the holes of squirrels, and has the odd habit of trying to screw its head off if you pass around it. This owl occupies an important place on the farm in keeping down small rodents. The short-eared and long-eared owls are great mousers, as also is the great horned owl, which will, when chance comes its way, take a roosting chicken out of the trees or bushes.

The farmer and fruit-grower have not, as a rule, given the proper attention to the observation of birds' habits, nor have they had access to convenient information; but happily the times are changing, so that our State agricultural stations are issuing important bulletins from time to time.

Of the many other birds that are related to the farmer may be mentioned the meadowlarks and blackbirds, to which I will call your attention at another time.

What orchardist in this Convention has taken the time to spend an hour, much less a day, among the birds of his orchard? Or did you ever try to count all the birds seen, or ascertain the number of times a parent bird carried insects to the gaping mouths of its young? These seemingly small facts play a more important part in the life of our trees than can be told in words. Take our little red-capped chipping sparrow, which builds its nest in your apple or pear tree; the parent birds will make from fourteen to twenty feeding trips an hour to the nest, and in some cases the animal matter counts up into ounces instead of grains, according to the demands of the young birds for food.

In watching the work done by the warbling vireo, bush-tit, and the goldfinches in picking the limbs and branches clean of spiders, larvæ, and scale we should realize that the work goes on the year round. Kinglets, juncos, and warblers can be seen any day during the winter cleaning the bare branches of scale. The little mouse-like bush-tit, of plain gray color, moves in large flocks among the trees, feeding industriously on the bark lice, spiders, and scales. Stomachs that have been examined at the Biological Survey of the Department of Agriculture contained the black scale (*Lecanium oleæ*) from the California olive groves. (See Yearbook for 1900, p. 296, "How Birds Affect the Orchard," by F. E. L. Beal, B.S., Department of Agriculture, Washington, D. C.)

Some birds found in our orchards, as the California brown towhee, black-headed grosbeak, Brewer's blackbird, and Bullock's oriole, are charged with the destruction of the fruit more or less in some localities—a fact in common with our insectivorous birds, such as the small thrushes. This could to a certain degree be remedied by the planting of a few trees of wild cherry, elderberry, or mulberry throughout the orchard or along the fence lines, as all birds prefer wild fruit to domestic, when obtainable. This will be noted where there are wild vines or berry-producing shrubs and trees. I have often watched the thrushes, robins, and even some of the smaller flycatchers feeding on the elder, wild holly, or madrone fruits.

Every few years there comes information relative to the vast numbers of some bird sweeping down on the orchards, causing sometimes great damage to crops. These depredations in many instances are in isolated glens or on hill-slopes, particularly those adjacent to wooded tracts. The early fruits are always tempting morsels to the birds, in addition to their regular diet. In years of drought or late frosts the wild fruits will oftimes be less abundant than the domestic, and then the birds are at their worst on crops. Another cause is the late continuous storms in the tracks of migrating birds, particularly of northern or mountain-breeding species, which will cause a change in movements and the birds to tarry, especially if there be plenty of ripe fruit in the locality.

A case that occurred some years ago was that of the Louisiana tanager, which made its appearance first at Pasadena during May, 1896. They came by thousands, to the great loss of the cherry-growers, one orchardist not getting enough out of his crop to pay for the powder and shot used in trying to rid his orchard of them. Three thousand tanagers were counted on one piece of land. Ten days later I noted them around Haywards for two weeks, they being present in great numbers in the small outlying tracts near the foothills. From that year to the present time they have only been seen in a few single instances. Another case worth mentioning, as it has caused a great deal of discussion on the question of bird protection, is the appearance of robins in the Santa Clara olive orchards. As to whether or not the robins will keep up their record as each season opens remains to be seen.

Where there is a necessary food-supply spread over the country and natural conditions prevail, there is, as a rule, no great movement of birds toward the cultivated areas. When Nature changes any of her food-supply fields it also has the tendency to change the habits of the fauna inhabiting the region, and sometimes man's crops must suffer. Note the influx of great bands of wild pigeons driven from their snow-covered summer home to southern climes last spring. This came about seeding-time around the bay, and the farmers were up in arms, causing the pigeons to be shot by thousands. A four-horse wagon could have been loaded in one field below Alvarado, Alameda County.

All the woodpeckers (*Picidæ*) are valuable tenants of the orchard, excepting, perhaps, the red-breasted sapsucker, the only variety of this group found along the coast region of California, it being only a winter visitant from the high mountains. They will be found about the apple, pear, and orange trees, pecking a series of holes encircling the trunk or limbs, as the case may be. They seem to feed on the inner bark and the sap which collects in the holes. Among the nut-growers complaint is made of some woodpeckers (notably the California and the Lewis) damaging the nuts; but if carefully inquired into it will be found that larvæ or worms exist in the nuts so pecked. The woodpeckers are great hunters after wood pests, hammering away at the abodes of the grubs and borers. The red-shafted flicker is a fine codling-moth trap, even going into the apples after them, let alone cleaning out the ground around the base of each tree. The peach-growers will find the flickers good friends, if given a chance by removing the earth from about the base of each tree for several inches in the early fall. We have three other species of small woodpeckers, black and white in color, with spotted wings, a stripe down the back, breast plain whitish, with a red patch at the back of the head in the males. They are Cabanis's, Nuttall's, and Gairdner's woodpeckers, Nuttall's having a spotted breast. The former species is twice as large as either of the latter two.

Other useful birds are wrens, titmice, warblers, thrushes, and flycatchers. All of these are wholly insectivorous, and should be protected all the year round by the farmer and fruit-grower, who should recognize in them most able allies in the welfare of the farm.

A MEMBER. Have you got any good points to tell us about the bluejay?

MR. EMERSON. The bluejay has got a bad reputation in this State. We shot three or four hundred last year to make an examination of their food, and found that it is ready to eat anything, from a hen's egg to a prune, at some time of the year. At some other times it is beneficial, on account of the amount of animal matter it consumes. Probably about two fifths of its food is animal matter. But the other part of its diet is against the bird.

A MEMBER. Have you made any examination of the food eaten by the king-bird and mocking-bird?

MR. EMERSON. The king-bird is a true flycatcher. They will hover over the stands of bees and feed more or less during the whole day. It has been discovered, however, that they only eat the dead bees.

A MEMBER. Do you know of any birds that will feed on any of the young fruit buds?

MR. EMERSON. The sparrows and linnets will feed on the fruit buds early in the spring. Sometimes when they feed on prune buds I think it is a benefit, for often the prunes need thinning out.

Upon motion, the paper by Mr. Emerson was received and placed on file.

RESOLUTIONS OF THANKS.

MR. AIKEN. The Committee on Resolutions wish to present the following:

> We, the fruit-growers of California, desire to show our gratitude to the State Board of Horticulture for this feast of knowledge it has prepared for us, and the invitation it has extended to us to visit San Francisco, where we have learned so much of interest.

I move that the thanks of the fruit-growers be extended to the State Board of Horticulture and its officers for the interesting programme that has been presented, and to all who have taken part in it. In speaking of that, I think I had better, owing to the delicacy of the position, as I refer to the officers now in the chair, present the resolution to the Convention. All in favor of extending to the Board the thanks that are offered, say "I."

Carried unanimously.

MR. AIKEN. I further wish to say that the Press has been instrumental in doing great good to the horticultural interests of the State by its fair and able presentation of the subjects coming before us for contemplation, and its great facility of expression and power of condensation have made it possible for our proceedings to be read by a great many people throughout the State. I move that the thanks of this Convention be extended to the Press.

Motion carried unanimously.

MR. STEPHENS. I move that a vote of thanks be extended to the Chairman of this Convention for the dignified and impartial manner in which he has discharged his duties. All in favor of the motion, say "I."

Carried unanimously.

PRESIDENT COOPER. The Convention has my thanks. I appreciate the compliment, and I will say that I extend to the members of the Convention, for their good order and harmony and general good feeling during the entire meeting, my heartfelt thanks.

MR. A. D. PRYAL, of Oakland. I move a vote of thanks to the Vice-President of this Convention—the gentleman who now is before you, who fills a very high position in the Department of Agriculture in the University of California, and whose work is known from ocean to ocean, Professor Wickson.

Motion carried unanimously.

PROFESSOR WICKSON. I return my sincere thanks and deep appreciation of the honor conferred. I would also like to make a motion on my own behalf, that is, by way of recognition of the services that have been rendered in the preparations for this meeting. We recognize that the arrangements have been excellent, but we do not realize the amount of work done in the weeks past preparatory to this Convention. I desire very much that the thanks of this Convention be tendered to Mr. B. N. Rowley, chairman of the Committee on Arrangements, for the excellent preparations he has made for the Convention which we have so thoroughly enjoyed.

Motion carried.

Upon motion, the Convention adjourned *sine die*.

JOHN ISAAC,
Secretary.

ELLWOOD COOPER,
President.

APPENDIX.

CORRESPONDENCE BETWEEN CHAIRMAN OF COMMITTEE ON TRANSPORTATION AND VARIOUS RAILWAY MANAGERS.

The following correspondence passed between Mr. Stephens, as Chairman of the Committee on Transportation, and William Sproule, Freight Traffic Manager of the Southern Pacific, Robert Graham, Manager of the F. G. E. Refrigerator Car Line, and others, and is self-explanatory. It is presented herewith in order that the fruit-growers of the State may have a clear understanding of the points involved in the matter at issue between themselves, the railroads, and the refrigerator companies:

Letter from William Sproule.

SOUTHERN PACIFIC COMPANY,
SAN FRANCISCO, CAL., May 21, 1901.

MR. R. D. STEPHENS,
Chairman Transportation Committee, Fruit Growers and Shippers,
Sacramento, Cal.:

DEAR SIR:

DECIDUOUS FRUIT TRAFFIC.

Referring to the memorial from the fruit-growers of California to the transportation companies through committee of fruit-growers, of which you are the chairman, and copy of which was duly furnished this office.

I beg to say that we have had extended correspondence with our connections, looking to a time-schedule on deciduous fruit from Northern California, during the season now opening, that would be as far as feasible in line with the wishes of the fruit-growers.

As expressed to you when I had the pleasure of appearing before the convention at its session in this city in December last, it is the desire of this company to do its share in fostering the fruit industry, and lend it our influence in giving it satisfactory transportation.

Am now able to say to you accordingly that it is the intention of this company to run trainloads of fresh fruit from Sacramento to Ogden, within 60 hours, provided, if there is but one train, it be ready for departure from Sacramento not later than 12 o'clock midnight; if two or three trainloads, it will be necessary that the first and second be ready to go out at earlier hours, say at 10 and 11, respectively.

The Union Pacific and its connections have authorized us to say that their time from Ogden to Chicago will approximate 84 hours for shipments thus delivered them in trainload lots, of which 24 hours will be consumed from Council Bluffs to Chicago.

You will observe that this will bring the fruit into Chicago in the early morning hours; as a shipment, for example, which leaves Sacramento on Monday midnight, would arrive in Chicago on the morning of the following Monday—this, too, bearing in mind the two hours difference in time owing to meridian.

If, when shipments begin in quantity so as to make up trainloads, shippers will so arrange their forwardings as to give the whole trainload to one connection through to

Chicago, believe you will find results justify the effort. This can be done without giving one line an undue proportion of the business, by alternating the lines over which the trains would move; but all notify us that unless they can get the fruit in trainloads, they can not make the schedule called for. It will make no difference in our time up to Ogden whether the fruit is there delivered to the Union Pacific or to the Rio Grande Western.

East of Ogden the Rio Grande-Pueblo route, recognizing the conditions under which the traffic moves, will aim to meet the time of the Council Bluffs route indicated in the foregoing.

Shipments for St. Paul and Minneapolis on the one hand, and St. Louis on the other, will be handled from point of divergence on the scheduled trains of the line handling the fruit from the Missouri River.

East of Chicago lines will handle as heretofore, the Erie Railroad Company notifying us that their high-class freight train, which carries the fruit, leaves Chicago in the afternoon, but reaches New York on or about 4:30 A. M. third morning, Philadelphia 6:30 A. M. third morning, Boston 4 A. M. fourth morning out from Chicago.

You are aware that the standard for fast trains carrying perishable freight from Chicago to New York is about sixty hours. Lines east of Chicago point out that to speed up their trains in this business would not mend matters, as the fruit would arrive either in the afternoon or the early night hours prior to present arrival, and from either the shippers would derive no benefit as compared with present deliveries; further than this, the way is not clear to handling California fruit on faster schedule time than the perishable freight local to their own lines.

With reference to the minimum load of green fruit per car, you have already been notified by the agent of the Transcontinental Freight Bureau that the lines have decided to reduce this minimum from 26,000 to 24,000 pounds per car, which I am gratified to hereby confirm, this concession being made to meet the views your memorial sets forth.

Trust that you will concur that the foregoing indicates that the expressions given your Convention of intention to go into this matter carefully and endeavor to meet the needs of the fruit-growers as expressed in that Convention, have not been lost sight of, but, on the contrary, are being fulfilled. We trust that the results during the season about to open will bring profit to the fruit-growers and renewed friendly relations with the carriers.

Will you kindly acknowledge receipt?

Yours truly,

(Signed:) WILLIAM SPROULE.

R. D. Stephens to Robert Graham.

SACRAMENTO, November 20, 1901.

MR. ROBERT GRAHAM,
Mgr. F. G. E. Ref. Car Line,
Sacramento, Cal.:

DEAR SIR: As the question of cost for refrigeration is one of great importance to the fruit-growers of the State, and materially affects their interests, I, as chairman of their Committee on Transportation, will ask you whether, for the season of 1902, it is probable that there will be a reduction from the charges for refrigeration made in 1901, for the transportation of California green deciduous fruit to Eastern markets, by the company you have the honor to represent.

I desire information on this subject so that I will be able to present it to the Fruit-Growers' Convention, which is called to meet in San Francisco on December 3, 1901.

Yours respectfully,

(Signed:) R. D. STEPHENS,
Chairman Cal. F. G. Transportation Committee.

Answer of Robert Graham to R. D. Stephens.

SACRAMENTO, CAL., November 21, 1901.

R. D. STEPHENS, ESQ.,
Chairman Cal. F. G. Transportation Committee,
Sacramento, Cal.:

DEAR SIR: Your esteemed favor of November 20th received, and in reply beg leave to state that the tariff in effect during 1901 for refrigeration charges on green fruit from California will, as far as I know, be the same for the season of 1902, the rates being as low as it is possible to make them considering cost of ice, etc.

In this connection I beg leave to remind you of the enormous reduction which has been made since the inception of the Fruit-Growers' Express in 1895, the rates now being little more than one half, to some points, what they were then; the old rate to New York being $175; present rate, $100; old rate to Boston, $200; present rate, $105.

I note that the meeting of the Fruit-Growers' Convention takes place on December 3d in San Francisco, and feel sure that congratulations will be in order for the excellent season the fruit-growers of California have just experienced.

I beg leave to ask that you will tender to the members of the Convention the thanks of the Armour Car Lines for their patronage, and the best wishes of the company I represent for their future welfare.

Very respectfully yours,

ROBT. GRAHAM,
Manager.

Letter of C. B. Dewees to R. D. Stephens.

CONTINENTAL FRUIT EXPRESS,
OPERATING C. F. X. VENTILATOR-REFRIGERATOR CARS,

SACRAMENTO, CAL., November 23, 1901.

MR. R. D. STEPHENS,
Chairman Calif. F. G. Transportation Committee,
Sacramento, Cal.:

DEAR SIR: I have your valued favor of the 20th inst. in regard to the probable rates that will be charged for refrigeration during the season 1902.

It is not probable that there will be a further reduction in our charges for refrigeration next season. As you are aware, a material reduction has been made in refrigeration charges this season as compared with previous years, and it is not likely that a further reduction can be made in the present reduced rates, bearing in mind all conditions now prevailing.

Yours very truly,

(Signed:) C. B. DEWEES,
Manager.

R. D. Stephens's Reply to Mr. Graham.

SACRAMENTO, CAL., November 27, 1901.

MR. ROBERT GRAHAM,
Mgr. F. G. E. Ref. Car Line,
Sacramento, Cal.:

DEAR SIR: I shall have to ask pardon for delaying answer to yours of the 21st instant, and plead in mitigation that I was absent from the city when it arrived.

I will say in reply that your statement that "the enormous reduction" that has been made in refrigeration charges, etc., has no more bearing on the present and the future than the reductions that have been made in freight rates for green fruit in times past, when it cost $1,000 per car for a ten-ton minimum weight car, then reduced to $800, and then to $600, and again and again, until the present rate of $360 for a 24,000 minimum weight car to New York prevails, which amounts to a net reduction of 66⅔ per cent.

I will now give you some of the reasons why I feel justified in interrogating you upon the subject of refrigeration charges, and the possibility of a reduction from the present rate being made for next season.

When the F. G. E. Company's cars were accepted by the Porter Bros. Company, the rate from Sacramento to New York was $130 per car, and it was then understood that the shipper might put in as much weight as he pleased, without extra charge for refrigeration.

At this time there was strong competition, which necessitated the employment of special representatives who were sent into the various fruit districts to solicit business.

Now there is no competition.

The Armour lines have a monopoly of the fruit-carrying business from California to Eastern markets.

No longer is there need to employ agents to solicit business for its cars, for the shipper has to use them or none. *These facts should, and no doubt do, make an "enormous reduction" in the expense of the company.*

There is another reason that it seems would justify the belief that a reduction of no small magnitude could be made in the rates now prevailing, and still leave an enormous profit to the Armour Company, and this is the fact that the companies now under its control charged some years since but a small proportion of its present California rates for Oregon and Washington fruit shipments, and it is reasonable to assume that the refrigerator lines then doing business in these two States were doing it at a fair and reasonable profit.

In support of the correctness of this assumption, I offer the fact that the refrigerator cars are still doing business in these localities at a $35 rate to New York and other places.

You assume that the season of 1901 has been a very prosperous one for the California fruit-grower.

I wish I could join you in this assumption, but I can not do so so far as Eastern shipments are concerned, for some of them have brought "red ink" returns. That is, the price that they brought did not pay the transportation and commission charges, and others brought but little more; while many others failed to bring a profit to the growers when all costs are taken into consideration, including production, picking, packing, materials used—such as crates, boxes, nails, paper, etc.—taxes, together with a fair interest on the capital invested, and only equal to that which they have to pay upon the mortgaged indebtedness, if they have any, and the rule is that they have.

It is true that some growers have made money this year, but it is one year in ten, since 1891, that but few of them have been able to do so by shipping East; therefore, it would be unreasonable, and certainly it would not promote the horticultural interests of the State, to establish as a basis, from which to fix rates for refrigeration, the maximum prices received for shipments.

It frequently occurs that a grower receives what might be termed enormous prices for one shipment, and losing prices for ten others.

In conclusion, I will say, that there is no guarantee that prices that will bring a profit to the growers will prevail next year, nor for years thereafter, but, on the contrary, it is not at all improbable, and certainly not impossible, that conditions may prevail that will result disastrously to many of the growers; therefore, every care and precaution should be taken to prevent such a result, and this is why I am appealing to you now, hoping that you will see your way clear to recommend to your company a material reduction in its present charges for refrigeration.

Respectfully yours,

R. D. STEPHENS,
Chairman F. G. Transportation Committee.

R. D. Stephens to William Sproule.

SAN FRANCISCO, December 4, 1901.

MR. WILLIAM SPROULE,
F. T. M., S. P. Co., City:

DEAR SIR: In a communication addressed to me bearing date of May 21, 1901, you stated that arrangements had been perfected with the various railway companies that were interested in carrying California green deciduous fruit shipments to Eastern markets by which a very much improved service could and would be given to the fruit growers and shippers of the State.

I regret to say that all that was promised was not given. At the beginning of the season when a sufficient number of carloads were offered daily to make up special trains there was a very material improvement made in the service given, but later in the season the service was not so good and lower prices were obtained by our growers for their products that were shipped to and sold in Eastern markets.

As fast time and otherwise good service in the transportation of our green fruit shipments are of the utmost importance to the fruit-growers of the State, I will ask why the promises made by the Southern Pacific Company and its connections were not fully carried out, and also what will be done for them in this regard for the season 1902. I assure you that the fruit-growers appreciate the efforts made by the railroad to give them an improved service for the season just passed, and earnestly pray that all the promises made by them for the season 1901 will be fully carried out in 1902.

Yours respectfully,

R. D. STEPHENS,
Chairman Fruit-Growers' Committee
on Transportation.

Reply of Mr. Sproule.

SAN FRANCISCO, December 4, 1901.

MR. R. D. STEPHENS,
Chairman Fruit-Growers' Committee on Transportation,
Pioneer Hall, San Francisco:

MY DEAR SIR:

DECIDUOUS FRUIT SERVICE.

Acknowledging your letter of even date, I beg to say that in accordance with my letter to you of May 21st last we ran eighty fruit trains from Sacramento to Ogden within the time specified for trainloads, and the other trains (with the exception of some four or five which were delayed by wash-out) approximated the schedule; but the delayed fruit was mostly that which was not delivered us so that it could go forward in trainloads in accordance with the terms of the letter you refer to. There was a temporary derangement of the service while the Epworth League moved to and from California—several thousands in number, as you may remember—but we notified shippers of this in advance. At the same time we did not relax our efforts to give the fruit quick time, and the schedule was over-run but slightly.

The line west of Ogden handled the fruit this season under conditions of serious disadvantage—which conditions, however, were shared by all the lines in the United States to a greater or less degree, and whatever the freight, or whatever the route it took, the condition was one that would equally have to be contended against, to wit, our orders for locomotives have been filled very tardily, the industrial strikes (particularly pertaining to the steel trade in the Eastern States) so retarding those lines of construction in which steel entered that it was impossible for locomotive shops to turn out engines fast enough to fill requisitions. In anticipation of the season's business the first thing done this year was to put in requisitions for over one hundred locomotives, of which, up to beginning of November, we had received just twenty all told, notwithstanding that all pressure was brought to bear to get them on our rails. This large order for locomotives was in part to take care of the fruit business. So much for the service over our own rails.

The lines east of us were confronted with like conditions, and that, too, in the busiest season the United States has ever had. There was a decided effort made by all to segregate the California deciduous fruit traffic and give it preferred service. I think the claim is justified that the service is better than at any previous season, unless those special limited fruit trains which were experimented with some years since on a 120-hour schedule Sacramento to Chicago be alone excepted. To whatever extent the service was not up to standard toward the end of the season arose from the shortage of power on the part of all the railroads, and further from the fruit not being delivered us so that it could be handled in trainloads—particularly owing to splitting of the trains at Ogden, to which the letter of May 21st last to you made special reference. That the roads took decisive interest in the business was shown by the fact that we were able at all times to supply refrigerators for fruit, to do which it became necessary to give the returning cars fast service and not hold them for loads. The percentage consequently that returned loaded with any kind of freight was merely nominal, and on the contrary the empties were handled in preferred trains on time that would ordinarily not be given to any other than perishable fast freight.

It is a pleasing coincidence that improvement in the markets for California fresh fruit and improvement in the service have been manifested this season, and can only say that we rejoice with the growers in this condition, and in sympathy with the effort to maintain profitable markets will aim to secure reasonable and prompt transportation for the fruit during the coming season, both by maintaining the standard of our own efficiency and not relaxing our efforts with connecting lines.

Very truly yours,

(Signed:) WM. SPROULE.

Alden Anderson to R. D. Stephens.

The Alden Anderson Fruit Company,
Shippers of Almonds, Green and Dried Fruits
Suisun, Solano Co., Cal., January 2, 1902.

Hon. R. D. Stephens, *Sacramento, Cal.:*

Dear Sir: I herewith return to you report of committee, but without my signature. I have no doubt but that all the statements made therein are absolutely correct, but I dislike to sign same in the absence of knowledge on my part. This refers particularly to the relative cost of refrigerator charges.

I have been such a crank on the subject of transportation, and have thought that if we could fight and win one battle at a time it would be better than to divide our strength along different lines. There is so much to be done that I will never say a word or do anything that would retard progress in any direction.

I have recently been very busy, but intend, as soon as I get time, to look up for myself the comparative charges of refrigeration from all fruit districts.

Yours very truly,

(Signed:) ALDEN ANDERSON.

Mr. Stephens's Reply to Mr. Anderson.

Sacramento, Cal., January 4, 1902.

Hon. Alden Anderson, *Suisun, Cal.:*

Dear Sir: Yours of the 2d instant received, and, in reply, will say that all the other members of the committee regret that you do not now see your way clear to join them in their efforts to obtain the relief so necessary to make fruit-growing in California profitable.

The success of these efforts would do much to secure an equitable distribution of the profits among all parties interested. We feel thankful, however, for your indorsement of the truthfulness of the statements made in our report when you say in speaking of the report: "I have no doubt but that all the statements made therein are absolutely correct."

There should be a reduction of at least seventy per cent made in the existing charges for refrigeration, which would still leave a handsome profit for the car lines, and a much larger one than would be then received by the average fruit-grower for the capital and labor he has invested. Such a reduction would accomplish more for the fruit interests of the State than twice the amount in reduction in the freight rates, for the reason that it *would take from the refrigerator lines the power to give heavy rebates to a favored few, which system carries with it the power to control the distribution and marketing of our fruit products.*

So long as the present rates for refrigeration prevail, the fruit-growers of California will see no competition between buyers, for the reason that no man or firm can hope to successfully compete with those who may be favored under the rebate system.

Hoping that you will soon see your way clear to join the other members of the committee in their efforts to emancipate the fruit-growers of California, I remain,

Very truly yours,

(Signed:) R. D. STEPHENS,
Chairman Fruit-Growers' Transportation Committee.

William Sproule to R. D. Stephens.

SOUTHERN PACIFIC COMPANY—GENERAL FREIGHT DEPARTMENT,
SAN FRANCISCO, CAL., January 3, 1902.

MR. R. D. STEPHENS,
Chairman Fruit-Growers' Transportation Committee,
Sacramento, Cal.:

DEAR SIR:

TRANSPORTATION GREEN FRUITS EAST-BOUND.

I beg to acknowledge receipt in due course of your valued favor of the 23d ult., and thank you for copy of report of action taken by the fruit-growers of California at annual convention December 3-6, 1901, in regard to transportation of green fruits to Eastern markets, enclosed therewith.

You can rest assured this traffic will have the careful attention of this Company.

Yours truly,

(Signed:) WM. SPROULE.

W. A. Gardner to R. D. Stephens.

CHICAGO & NORTHWESTERN R'Y CO.,
OFFICE OF THE GENERAL MANAGER,
CHICAGO, December 26, 1901.

MR. R. D. STEPHENS,
Chairman Fruit-Growers' Association Committee,
Sacramento, Cal.:

DEAR SIR: We wish to thank you for your letter of December 23d, enclosing reports of Fruit-Growers' Association.

Yours truly,

(Signed:) W. A. GARDNER.

G. H. Crosby to R. D. Stephens.

BURLINGTON & MISSOURI RIVER RAILROAD IN NEBRASKA,
GENERAL FREIGHT DEPARTMENT,
OMAHA, December 26, 1901.

MR. R. D. STEPHENS,
Chairman Fruit-Growers' Transportation Committee,
Sacramento, Cal.:

DEAR SIR: I have your letter of the 23d, enclosing report of action taken at Fruit-Growers' meeting held in San Francisco, December 3d to 6th. I have carefully noted the same. I will say that I think the carriers are using every possible effort to improve the service in the matter of time, and I believe with the greater experience we are having in the matter of handling this traffic, that we will be able to meet the views of the growers.

So far as contracts with private car lines are concerned, I would say that this company has none. We handle all kinds of cars without having any special contract with any line.

Yours truly,
(Signed:) GEORGE H. CROSBY.

C. Clifford to R. D. Stephens.

UNION PACIFIC RAILROAD COMPANY—TRAFFIC DEPARTMENT,
SAN FRANCISCO, January 7, 1902.

MR. R. D. STEPHENS,
Chairman Fruit-Growers' Transportation Committee,
Sacramento, Cal.:

DEAR SIR: Am pleased to acknowledge receipt of your letter of the 2d inst., together with copy of the recommendations which were made by your Transportation Committee at your San Francisco, December, 1901, meeting, also a copy of Mr. Sproule's letter of May 21st, 1901.

Of course you know that the Union Pacific has always shown a disposition to assist the fruit-growers to the fullest extent possible, and I am very glad, indeed, to be able to refer all papers, together with your letter of January 2d, to our Freight Traffic Manager, Mr. J. A. Munroe.

Yours truly,
(Signed:) C. CLIFFORD.

E. P. Ripley to R. D. Stephens.

THE ATCHISON, TOPEKA & SANTA FÉ RAILWAY SYSTEM,
PRESIDENT'S OFFICE,
CHICAGO, January 2, 1902.

MR. R. D. STEPHENS,
Chairman Fruit-Growers' Transportation Committee,
Sacramento, Cal.:

DEAR SIR: I have yours of the 28th ult., enclosing report of action taken by the fruit-growers of California at their State Convention at San Francisco, December 3–6, and in reply beg to advise you:

First—That existing contracts with private owners of refrigerator cars will expire before the citrus fruit season of next year begins, and will not be renewed, so far as this company is concerned, as by that time it will own a sufficient number of cars to transact its business direct with shippers without the intervention of a third party.

Second—That only a small part of the business done by this company requires refrigeration, as we are not largely engaged in carrying deciduous fruit, but that it will not be our policy to exact a profit from shippers as to refrigeration charges.

As to time in transit, it is probable that your committee and its constituents do not realize how rapidly transportation costs increase when high speed is called for and given, nor what obstacles are encountered by the transcontinental lines in attempting to make the very fast time requested by your committee. While I do not attempt to pass on the reasonableness of the six-day time to Chicago and eight days to New York on deciduous fruits from Sacramento, I am of the opinion that six days to Missouri River points and eight days to Chicago is quite as fast time as we can fairly afford to make from San Bernardino on citrus fruit, and that this time, *made regularly*, should satisfy all reasonable requirements. Indeed, I think that absolute regularity is more essential than fast time as to all the fruit business of California. We are exerting all our powers and are spending very large sums of money in the endeavor to accomplish this *regular* service, but few people outside of the carriers themselves realize the difficulty of keeping trains on time over a 2500-mile stretch, which embraces nearly all possible climatic and geographical variations. We are striving to make our freight service regular and reliable, and sparing no pains or expense. It is our desire to make the fruit industry in California profitable and satisfactory to the grower, in order that it may be the same for the carrier. As previously stated, we expect to meet the views of your committee next season as to the elimination of private cars and the reduction of refrigeration charges. We hope also to make good, and above all, *regular*, time, but we are not prepared to promise a reduction in schedule time at the present.

Yours truly,

(Signed:) E. P. RIPLEY.

EIGHTH BIENNIAL REPORT

OF THE

STATE BOARD OF HORTICULTURE

OF THE

STATE OF CALIFORNIA,

FOR 1901-1902.

SACRAMENTO:
A. J. JOHNSTON, : : : : : : : SUPERINTENDENT STATE PRINTING.
1902.

CALIFORNIA STATE BOARD OF HORTICULTURE.

ELLWOOD COOPER.................President.................Santa Barbara,
Commissioner for the Los Angeles District.

FRANK H. BUCK.................Vice-President.................Vacaville,
Commissioner for the Napa District.

RUSS D. STEPHENS.................Auditor and Treasurer.................Sacramento,
Commissioner for the State at Large.

A. B. HUMPHREY.................Treasurer.................Sacramento,
Commissioner for the Sacramento District.

M. J. DANIELS.................Riverside,
Commissioner for the State at Large.

THOMAS A. HENDER.................Sonora,
Commissioner for the El Dorado District.

A. C. EISEN.................Fresno,
Commissioner for the San Joaquin District.

A. B. CASH.................Santa Clara,
Commissioner for the San Francisco District.

W. J. HOTCHKISS.................Healdsburg,
Commissioner for the Sonoma District.

J. J. KEEGAN.................Secretary,
Office: State Capitol, Sacramento.

ALEXANDER CRAW.................Quarantine Officer and Entomologist,
Office: Clay Street Dock, San Francisco.

GERTRUDE BIRD.................Clerk.

OFFICES:

State Capitol, Sacramento.

Branch Office, Clay Street Dock, San Francisco.

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REPORT.

OFFICE OF STATE BOARD OF HORTICULTURE,
STATE CAPITOL, SACRAMENTO, CAL., December 31, 1902.

To His Excellency HENRY T. GAGE, *Governor, and the Honorable the Senate and Assembly of California:*

We have the honor to submit herewith this, our biennial report, showing the operations of the State Board of Horticulture for the years 1901 and 1902.

Respectfully submitted.

ELLWOOD COOPER,
FRANK H. BUCK,
THOS. A. HENDER,
M. J. DANIELS,
A. B. HUMPHREY,
A. C. EISEN,
A. B. CASH,
W. J. HOTCHKISS,
R. D. STEPHENS,
Commissioners.

Attest:
J. J. KEEGAN, Secretary.

REPORT OF THE SECRETARY.

To the Honorable the State Board of Horticulture:

Gentlemen: On May 3, 1901, B. M. Lelong, who had for many years been the able and efficient Secretary and Chief Horticultural Officer of the State Board of Horticulture, died in Sacramento. His aid to the horticulturists of this State had been of the greatest value, as evidenced by the number of bulletins that had been issued under his supervision, on horticulture and the propagation, budding, and grafting of deciduous fruit, nut, and citrus trees. His crowning work, and his last, "Culture of the Citrus in California," was issued shortly before his death, and the demand for it, from all over the world, was so great that the first edition was soon exhausted and the Board was compelled to issue a revised edition of 2,000 copies during the present year, in order to supply the many requests for it, which still continue. By the death of Mr. Lelong the horticulturists of this State lost a most valuable and energetic worker, and many warm friends and acquaintances mourn his early demise.

Alexander Craw, Quarantine Officer and Entomologist of the Board, assumed charge of the office temporarily, and performed the duties with his accustomed ability and dispatch.

A letter was received from Wm. B. Gester, Commissioner from the El Dorado district, and Treasurer of the Board, dated Saucillo, Chihuahua, Mexico, May 11, 1901, and presented to the Board at their meeting of May 20, 1901, suggesting that, in view of his absence from the State, some one else should be elected to the office of Treasurer. H. Weinstock, of the Sacramento district, was unanimously elected Treasurer.

July 20, 1901, John Isaac was appointed Secretary ad interim, pending the regular election of the Secretary, but was detained in the Quarantine Department until August 1, 1901.

A decision having been rendered by Judge Ellison, of Tehama, that County Horticultural Commissioners, and Local Inspectors appointed by County Horticultural Commissioners, have no right to inspect and condemn nursery stock imported into this State, that power being conferred exclusively upon the State Board of Horticulture and the Quarantine Guardians appointed by the State Board, Mr. Isaac issued certificates of quarantine guardianship to all the County Horticultural Commissioners and Local Inspectors in the State, empowering them to act as officers of the Board to protect the fruit interests of the different counties according to law. The counties of this State which have appointed Horticultural Commissioners are thus protected from the danger of importing injurious fungous and insect pests. Thirty-one counties of the State, the principal horticultural ones, have complied with the law. A pamphlet containing the names and addresses of all the County Horticultural Commissioners, Local Inspectors, and Quarantine Guardians was compiled and issued by Mr. Isaac. He also compiled, in a pamphlet of fifty-seven pages, the Horticultural Statutes of California, with court decisions and legal opinions relating thereto, and forwarded copies to the Horticultural Commissioners in the different counties. It will prove a great aid to them and facilitate their action.

I assumed the duties of Secretary and Chief Horticultural Officer of the State Board of Horticulture January 1, 1902, succeeding John Isaac, who had been appointed Secretary pending the election of a successor to B. M. Lelong, deceased.

On January 4, 1902, I forwarded to the Attorney-General the complaint of the Orchardists' Association of the Pajaro Valley against Reddington & Co. and Mack & Co., of San Francisco, for selling Paris green which did not comply with the requirements of the law. A reply was received from the Attorney-General, acknowledging the receipt of the complaint, and promising to give the matter prompt attention.

On March 6, 1902, a letter was received from Professor Woodworth, proposing the coöperation of this Board with the University of California in the publication of a bulletin on the principal pernicious and beneficial insects of this State. The appropriation allowed for printing is only $2,500 per year, all of which is consumed in the publication of the proceedings of the Fruit-Growers' Convention, Biennial Report, and the necessary bulletins issued by this Board from time to time, leaving no surplus for such work.

On March 8, 1902, John Isaac was appointed Special Agent of this Board by the Executive Committee, and instructed to visit and inspect the orchards in the different counties of this State and report on the extent and destructiveness of the pear-blight, olive-knot, and other diseases existing and threatening the horticultural interests of the State, and incidentally to inquire into the probability of introducing the Morelos orange maggot (which is not now found in our State) across the Mexican border into our orange-growing section. From time to time reports were filed in this office by Mr. Isaac, which will be found under their headings in the Biennial Report.

On May 15, 1902, the following letter was received from J. A. Filcher, Secretary and General Manager of the California State Board of Trade:

San Francisco, Cal., May 14, 1902.

J. J. Keegan, Esq., *Secretary State Board of Horticulture, Sacramento, California:*

Dear Sir: At the meeting of the State Board of Trade, held on the 13th of this month, the following resolution, introduced by President Chipman, of the Board, was unanimously adopted, viz:

"Whereas, The attention of this Board has been called to the fact that a certain firm in the City of Los Angeles has been selling to consumers, as a ripe pickled olive, an imitation ripe olive which is dangerous to health, if not to life itself; and,

"WHEREAS, It has been declared that these olives were cured green and afterward colored black, by the use of a deleterious coloring matter, to imitate ripe olives; and,

"WHEREAS, It is of the highest importance to the olive industry of this State that such vicious and fraudulent practices be prevented and the perpetrators prosecuted to the limit of the law; therefore,

"*Resolved*, That the State Board of Horticulture be requested to ask the opinion of the Attorney-General of the State as to whether the guilty parties can be prosecuted under any law of the State or United States, and if so, that steps be taken at once to enforce such law;

"*Resolved further*, That the Secretary of this Board enclose with a copy hereof the facts as stated by the Los Angeles Times of April 6, 1902, and in the letter of Hon. Ellwood Cooper, and forward the same to the Secretary of the State Board of Horticulture."

The foregoing resolution is self-explanatory. A copy of the article from the Los Angeles Times referred to and the letter of Hon. Ellwood Cooper are herewith enclosed.

Trusting your organization will take up this matter vigorously and make it so uncomfortable for the offender that like practices will not be indulged in in the future, I remain

Yours very truly,

J. A. FILCHER,
Secretary and General Manager.

The foregoing letter was accompanied by a letter from President Ellwood Cooper of this Board on the proper pickling of olives, and deprecating the coloring of green olives in any manner to resemble ripe olives and severely condemning such practice. Also, by an extract from the Los Angeles Times, giving an account of people who had suffered severely from the effects of the coloring matter which had been used on olives.

Believing that the laws of this State were amply sufficient for the prosecution and conviction of the guilty parties, I communicated with the District Attorney and Health Officer of Los Angeles, to ascertain if any action had been taken toward the prosecution of the parties who had been engaged in such practices. Replies were received, stating that the guilty parties had been promptly prosecuted and heavily fined. Copies of these letters were forwarded to the State Board of Trade, and a reply was received from General Manager J. A. Filcher, stating that these communications served as an answer to the resolution adopted by that Board, and that they would be read at the next meeting of the Board of Trade, much to the interest of the members.

The first edition of "Culture of the Citrus in California" having become exhausted, a revised edition was prepared, and articles on the "Mottled Leaf," "The Die-Back Trouble," "Cultivation and Irrigation," "Orange and Lemon Rot," and other data, to bring the work up to date, were inserted. An edition of two thousand copies was ordered printed. The many requests for copies of this work which had been accumulating for some time have been complied with, and the orders received almost daily are promptly filled.

Complaints of grasshoppers appearing in large and threatening numbers had been made from widely separated and isolated places in the State, and in some sections parties had been burning the grass on pasture lands in order to destroy the pests, against the protests of the owners, who were threatening to oppose force to such means of destruction, and conflicts between the owners of pasture lands and those engaged in their burning-over, in some localities under orders from Supervisors, were occurring. In order to ascertain the exact legal rights and powers of all parties in the matter, on June 16, 1902, President Dillman, of the Board of Supervisors of Sacramento County, requested me to obtain an opinion from the Attorney-General on the powers of the State to protect the orchards of certain counties in the Sacramento Valley from threatened destruction by the so-called grasshopper plague, and the authority and power which may be exercised by the State Board of Horticulture in connection with the above matter. The reasons assigned by Mr. Dillman were that Sacramento County was engaged in fighting the pests by burning-over pasture lands where the grasshoppers were numerous; that the adjoining counties, particularly Placer County, refused to take such action; and that all the labor and sacrifices of Sacramento County would be in vain unless the same action was taken by adjoining counties. Professor Woodworth, Entomologist of the California State University, accompanied Mr. Dillman. In reply to the inquiry, whether he favored the proposed burning-over of pasture lands, Professor Woodworth stated that he deemed it advisable. The matter of the determination of the power to burn the grass on pasture lands without the consent of the owner was deemed most urgent, and I was requested to communicate with the Attorney-General by telephone, and was assured that he would promptly reply in the same manner. I immediately complied with the request, and the following opinion was received:

ATTORNEY-GENERAL'S OFFICE, STATE OF CALIFORNIA,
SAN FRANCISCO, CAL., June 17, 1902.

MR. J. J. KEEGAN, *Secretary State Board of Horticulture, Sacramento, Cal.:*

DEAR SIR: You ask the opinion of this office respecting—

1. The power of the State to protect the orchards of certain counties in the Sacramento Valley from threatened destruction by the so-called grasshopper plague.

2. The authority and power which may be exercised by the State Board of Horticulture in connection with the above matter.

In reply to your first inquiry, I beg to say that the State of California, in its sovereign capacity, is clothed with inherent power to protect and preserve its own existence and to do all things needful to prevent or avert a threatened calamity involving widespread destruction of persons or property. This power is based, in part, upon the old and well-known principle that private right is, and always must be, subservient to the public good. In exercising the power thus inherently belonging to the sovereign, the State of California may, where it becomes necessary, take, use, or destroy the private property of individuals to prevent the impending calamity; as, for instance, to stop the spreading of a fire, to stay the ravages of a pestilence, to arrest the advance of a hostile army, or to prevent any other great public calamity. This power of the State to act in cases of great public necessity does not require statutory authority, but comes directly from the natural law, from the right of self-preservation.

Of course, the facts must warrant the exercise of this unusual and extraordinary power of the State. According to the authorities the necessity therefor must be "extreme, imperative, and overwhelming." Whether the facts to which you refer would warrant the exercise of the power above noted, is a question upon which I can, of course, express no opinion. This question being one of fact must be determined by those who represent the State in the exercise of the above-described power. If the threatened calamity to which you refer is imminent, grave, and far-reaching in its results; if it affects a considerable section of the State, involving several counties therein; if the burning-over of several pasture lands will prevent the threatened calamity; if by no other means the threatened calamity can be averted; then, in my judgment, a condition has arisen which would warrant the State in making use of the inherent and sovereign power above noted.

Referring to the second branch of your inquiry, I beg to state that the State Board of Horticulture, being a creature of the statute, is clothed with no sovereign powers, but is limited to the powers specifically conferred upon it by statute or those necessarily implied from the statutory powers thus specifically granted. I find no statutory authority which would warrant your Board in taking any of the suggested steps to arrest the threatened calamity to which you refer, such as the burning of pasture lands and the like; nor do I find any statute of this State conferring upon any officer, specifically, the powers herein discussed. It follows, therefore, that this power of the State can alone be exercised by its Chief Executive, in whom, under the provisions of our State Constitution, is vested the supreme executive power of the State.

Very truly yours,

TIREY L. FORD,
Attorney-General.

Governor Gage, on being informed of the contents of this opinion, called a conference on June 19, 1902, in San Francisco, which was attended by Commissioners Stephens and Weinstock, representing the State Board of Horticulture, M. J. Dillman, Chairman of the Board of Supervisors of Sacramento County, and Professors Woodworth and Clarke, entomologists of the California University.

The objection of the cattlemen of El Dorado and Placer counties to the indiscriminate burning-over of their pasture lands was discussed, and it was agreed that they should be remunerated by the State. Governor Gage, considering the necessity of immediate action, stated that he would recommend to the next Legislature the passage of a bill appropriating a sum not exceeding $10,000, to pay the claims of owners of land in Sacramento, El Dorado, and Placer counties that might be burned over by orders of the State Board of Horticulture in its endeavors to destroy the grasshoppers.

A line of action was then agreed on, whereby an agreement was to be entered into with the owners of lands on which the grass was proposed to be burned, specifying the number of acres, situation of the land, to whom belonging, and the agreed value of the damage to said land per acre. The grass on said lands should be burned by the authority of the State Board of Horticulture, under the immediate advice and direction of Professors Woodworth and Clarke, but under no circumstances should any land be burned over or other property damaged except under the terms of the agreement. The Secretary was instructed to proceed, in company with Professors Woodworth and

Clarke, to inspect the lands in Placer, Sacramento, and El Dorado counties infested with grasshoppers, and to enter into agreements with the owners in accordance with the above terms and then have burned the grass on such lands.

On June 20, 1902, a conference, attended by Commissioners Stephens and Weinstock and Secretary Keegan of this Board and Professors Woodworth and Clarke, was held in the rooms of the Board at Sacramento. It was shown that the proposed line of action was not authorized by any statutory law, and that the parties authorizing the setting of fire would be held responsible for all damage (which might amount to thousands of dollars) that might accrue other than that specified in the agreement, such as, for instance, the burning of buildings, fences, crops, etc., in the event of the fire getting beyond control.

Mr. Kaseburg, owner of 17,000 acres of land in Placer County, 1,200 acres of which it was proposed to burn over, was present at the meeting, and positively refused to enter into any agreement for the burning of any grass on his land, but said that, like a good citizen, he would submit. He gave as his reason his fear of fire, and most graphically related his terrifying experience with a former field-fire which had swept over his ranch, and that the citizens of Roseville, in fear of the destruction of their town, had moved their household goods into the streets in the hope that they might be able to preserve them from destruction by the threatening field-fires. He had lost two residences by fires in former years.

As it would have been useless to burn the grass on small tracts, allowing that on the larger areas to remain as a menace, and there being no assurance that any owners would consent to the burning of grass on their lands, the Board, after consultation, decided to fight the pests by means of "hopper-dosers," which would inflict damage on no one, and which have proved highly effective in the past, being recommended by the Agricultural Experiment Stations in the States afflicted with grasshoppers and by the United States Department of Agriculture.

It was decided to have a number of "hopper-dozers" made immediately, to be furnished free on application, the farmers to furnish the teams and men to operate them. The Board had constructed twenty-five "hopper-dozers," at a cost of $77. But three applications were received for "hopper-dozers" during June, from parties in the threatened localities.

From the fact that so few applications were received for these "hopper-dozers," or other measures, or seeking advice for relief from grasshoppers, by the farmers and horticulturists, the parties subject to injuries, it is a reasonable surmise that there was no necessity for such drastic measures as setting fields afire at the dry season of the year, and that the action of this Board was most beneficent for the good of the entire community and proved to be ample to afford the necessary protection without doing injury to any, or jeopardizing itself and costing the State thousands of dollars for damages. Besides, the destruction of the grass would have entailed great hardship on the owners of livestock when they returned their herds in the fall from the high Sierras where they annually summer-pasture their stock.

I have written to a number of Boards of Agriculture and Horticultural Societies in the different States for copies of their reports to complete to date those that we now have on the shelves of the library, a number of which are missing, and many have been received.

I have also written to the Directors of all the Agricultural Experiment Stations of the United States, requesting them to send any bulletins they could spare on botany, field experiments, horticulture, diseases of plants, irrigation and drainage, mycology, and entomology. These works I consider of the greatest value, and a large number have been received, arranged under proper classification, and prepared for binding.

The books on the shelves of the library have been arranged, classified, and numbered, and a catalogue is now being prepared, giving each book its number, shelf, and division. It is now nearly ready for the typewriter, only waiting to be alphabetically arranged.

On July 19, 1902, Alexander Craw, Quarantine Officer and Entomologist, rendered a synopsis of his semi-annual report, giving an interesting account of the transactions of his department. It will be found under its appropriate heading in this report.

The asparagus rust (*Puccinia asparagi*) has almost entirely destroyed the asparagus industry in many of the Eastern States, and is constantly and rapidly spreading. Our efficient Quarantine Officer, Mr. Craw, appreciating the danger to asparagus-growers in this State, has taken hold of the matter, and addressed the following letter to this Board:

San Francisco, July 16, 1902.

To the State Board of Horticulture, Capitol Building, Sacramento, Cal.:

Gentlemen: My attention has been called, by the Hickmott Asparagus Co. of this city, to the danger of introducing the destructive asparagus disease, or rust (*Puccinia asparagi*), into California upon asparagus roots or seeds from Europe, or east of the Rocky Mountains. Hundreds of thousands of dollars have been invested in asparagus culture, canning plants, etc., and the introduction of such a disease would be a serious blow to the industry.

I fear that detention or disinfection of the plants or seeds would not be sufficient to prevent the introduction of the fungi spores. I would therefore suggest that you submit the question to the Attorney-General for his opinion as to your powers to draw up a regulation absolutely prohibiting the bringing of asparagus seeds or plants from Europe or any of the United States or Territories into California. To exempt the Pacific Coast States would simply leave the doors open for indifferent or unscrupulous parties to bring such stock through those States.

I took the precaution to call public attention, through the press, to this danger. I herewith inclose a letter from Dr. A. F. Woods, United States Pathologist and Physiologist, Washington, D. C. Therein he shows how rapid its spread has been since its introduction into New Jersey in 1896.

Respectfully yours,

ALEXANDER CRAW,
Quarantine Officer, State Board of Horticulture.

The following letter, addressed to Mr. Craw, from A. F. Woods, Pathologist and Physiologist, U. S. Department of Agriculture, in response to a letter from Mr. Craw requesting information regarding asparagus rust, was received:

WASHINGTON, D. C., May 13, 1902.

MR. ALEXANDER CRAW, *State Board of Horticulture, San Francisco, Cal.:*

DEAR SIR: Your letter of May 6th, requesting information regarding asparagus rust in the Eastern States and the advisability of establishing quarantine regulations to prevent its introduction into California, has been referred to Mr. W. A. Orton, of this office, whose report follows.

The asparagus rust, which is caused by the attack of a fungus (*Puccinia asparagi*, DC.) is a native of Europe, and was first introduced into this country in New Jersey in 1896. In the four succeeding years it has spread over the whole eastern and central United States, doing an immense amount of damage, especially in the extensive trucking sections of the Atlantic coast from Massachusetts to South Carolina. It now occurs as far west as Nebraska and the Dakotas, and while we have no authoritative report on the subject from many States, it is probable that it occurs nearly everywhere east of the Rocky Mountains. There are doubtless individual farms in many places that are free from it, but all asparagus from any Eastern or Central State would be open to more or less suspicion.

The disease was reported from near Sacramento, Cal., in February, 1880, by Dr. Harkness, in his "Catalogue of the Pacific Coast Fungi." No specimens were preserved, and we have no further report from the State and no other reason to think that it still exists there.

The epidemic of rust in the East, which almost ruined the industry in many places, is now much abated, and less difficulty is experienced in controlling the disease, though it annually causes much loss. It seems to continue to be destructive in the West.

As regards the policy of your Board in its attempt to prevent the introduction of the disease into California, we hesitate to advise definitely, not being acquainted with your laws on the subject. It will be a difficult task for you to keep the rust out of California, though rigid enforcement of the proper rules may long delay its introduction. The greatest danger lies in the introduction of the rust in young plants from the East, and to make any quarantine effective, the importation of asparagus roots or plants from east of the Rocky Mountains would have to be entirely prohibited. We are not informed as to whether the California growers now purchase any plants from the Eastern States, but, if this is done, it will be practically impossible to avoid the introduction of the disease in the near future, on account of its general distribution throughout the Eastern States.

It will be impossible, in actual practice, to determine from an examination of roots of young plants whether or not they are affected by rust, as the fungus lives inside the tissues of the plants and does not appear on the outside until the plant is nearly grown, when it bursts through the stem and leaves to form spores, in much the same way that the grain rusts do. It is therefore evident that no distinction can be made between healthy and diseased plants as far as importations into California are concerned. The importation of asparagus seed from infected districts will also be attended with considerable risk. It is not probable that the rust fungus exists inside the seed, even though it came from diseased plants, but in the process of gathering and cleaning the seed, it will be very likely to come into contact with the rusty branches and get covered with the spores of the fungus. Such seed could be safely admitted if it were disinfected by soaking two hours in formalin (40 per cent formaldehyde), 1 part to 100 of water, and then dried and put up in a new package.

If we can advise you further in this matter, we shall be very glad to do so.

Yours very truly,

A. F. WOODS,
Pathologist and Physiologist.

Acting on the suggestion of Mr. Craw, I submitted the question to the Attorney-General, requesting his opinion as to the power of this Board to pass a regulation absolutely prohibiting the bringing of asparagus plants or seeds from Europe or any of the United States or Territories into California. The following is the opinion of the Attorney-General:

San Francisco, Cal., September 12, 1902.

Mr. J. J. Keegan, *Secretary State Board of Horticulture, Sacramento, California:*

Dear Sir: I am in receipt of yours of July 24, 1902, wherein you request my opinion as to the power of your Board to adopt regulations absolutely prohibiting the importation of asparagus plants or seeds, from Europe or any of the states or territories of this Nation, into this State. You inclose communications and literature, indicating the likelihood of disease to the domestic asparagus plants, from the importation of foreign plants and seeds.

In reply thereto, would say that the State Board of Horticulture has the power to adopt regulations forbidding the introduction into the State, of asparagus plants and seeds that are infested with pests or which come from districts where asparagus plants and seeds are subject to such pests, but has not the power to absolutely exclude all asparagus plants and seeds from being brought into the State.

* * * * * * * * * * * *

Ex Parte Cox, 63 Cal. 21.

The power of the Board in the premises does not extend much further than the authority expressly conferred upon the State horticultural quarantine officer by the Act of 1899. (Statute 1899, p. 91.) In arriving at these conclusions, I would cite

Railroad Co. vs. *Husen*, 95 U. S. 465;
Rasmussen vs. *Idaho*, 181 U. S. 198;
Schollenberger vs. *Pennsylvania*, 171 U. S. 1;
Smith vs. *Railway Co.*, 181 U. S. 248.

Very truly yours,

TIREY L. FORD, Attorney-General,
By A. A. MOORE, Jr., Deputy.

The matter was brought before the Executive Committee at a meeting held September 25, 1902. Telegrams were received, asking the Board to take prompt and radical action to protect and preserve this important growing industry of California. R. H. Hickmott, a grower having 1,000 acres of asparagus on Bouldin Island and also engaged in canning asparagus, appeared before the meeting and urged that all asparagus plants and seeds raised elsewhere be excluded from the State, for he feared that many plants would be imported in the near future because of the great success that has attended its culture in this State. After carefully considering the matter, it was decided that the only effective manner to protect the valuable and growing industry of asparagus-raising was to prohibit the introduction of asparagus plants or seeds into the State altogether. The following resolution was adopted:

Resolved, All asparagus roots and seeds raised in any place outside the boundaries of the State of California are hereby prohibited from being planted or offered for sale, gift, or distribution within the limits of the State of California.

The widest circulation possible was given to the above resolution.

Circular letters, containing the resolution and a synopsis of the letter of A. F. Woods, were printed and forwarded to the horticultural officers in the various counties, requesting that they be addressed to and placed in the hands of all nurserymen and seedsmen. It is confidently hoped that this timely action of the Board will prevent the introduction of the asparagus rust into this State, which would certainly destroy one of the most promising and remunerative agricultural industries of the State.

On September 12, 1902, a notice was received from H. Weinstock, that he had sent his resignation as a member of the State Board of Horticulture to Governor Gage on August 1, 1902. As he was also Treasurer of the Board, it was necessary, for the transaction of business and the prompt payment of bills, that his successor should be elected or appointed. As there was no quorum present at the meeting of the Board called for September 25, 1902, President Cooper, by the power vested in him by Section 15 of the Statute of 1889, appointed R. D. Stephens, of Sacramento, Commissioner for the State at large, as Treasurer of this Board. The consent of the Executive Committee of the Board to the appointment was given. Mr. Stephens immediately filed his bond and oath of office, and promptly paid the bills which had accumulated since June 30, 1902.

Mr. Weinstock submitted his report as Treasurer of the Board from June 30, 1901, to June 30, 1902. It showed that there had been received $6,288.31 and disbursed $6,258.30, leaving a balance of $30.01, for which a check payable to the State Board of Horticulture was presented. Of this total amount of disbursements, $1,926 was paid out in accordance with an Act making an appropriation to pay the claim of the State Board of Horticulture for moneys expended in behalf of the State of California, approved February 28, 1901.

In conclusion, I desire to express my sincere thanks to Commissioner R. D. Stephens, Chairman of the Executive Committee of this Board, for the aid he has given me in the discharge of my duties by his timely advice and counsel, which have always been willingly given; and having implicit confidence in his sagacity and ability, I have invariably followed the same, with benefit to the interests of the Board and State.

The following tables show the expenditures of the State Board of Horticulture for the fifty-second fiscal year ending June 30, 1901, and for the fifty-third fiscal year ending June 30, 1902. The accounts have been examined by the Executive Committee of the Board and compared with the Controller's books, and found to be correct:

Expenditures of the Appropriation for the Support of the State Board of Horticulture for the Fiscal Year ending June 30, 1901.

Twenty-fifth Fruit-Growers' Convention	$272 35
Books and papers	14 00
Chemicals, etc.	53 73
Extra help	547 10
Express	58 85
Freight and cartage	19 09
Furniture and repairing	113 22
Janitor	180 00
Miscellaneous	288 47
Postage	606 38
Salary of Deputy Quarantine Officer	845 00
Salaries of Special Agents	960 75
Traveling expenses of Deputy Quarantine Officer	73 60
Traveling expenses of Secretary	287 50
Traveling expenses of Quarantine Officer	91 15
Traveling expenses of Commissioners	450 48
Telephone and telegrams	151 57
	$5,013 24

Unexpended, fifty-first fiscal year	$13 24
Appropriation	$5,000 00
	$5,013 24
Expenditures, fifty-second fiscal year	5,013 24
Balance	None.

Expenditures of the Appropriation for the Support of the State Board of Horticulture for the Fiscal Year ending June 30, 1902.

Chemicals	$18 10
Extra help	281 09
Express	67 37
Fruit-Growers' Convention	276 65
Furniture and repairing	249 40
Freight and cartage	22 47
Janitor	180 00
Library	69 25
Miscellaneous	298 85
Postage	299 85
Salary of Special Agent	720 33
Salary of Deputy Quarantine Officer	30 00
Traveling expenses of Special Agent and Deputy Quarantine Officer	244 00
Traveling expenses of Quarantine Officer	146 30
Traveling expenses of Commissioners	436 05
Telephones and telegrams	101 45
	$3,441 16

Appropriation	$5,000 00
Expenditures, fifty-third fiscal year	3,441 16
Balance	$1,558 84

Expenditures of the Appropriation for Sending an Expert to Foreign Countries to Collect, Import, and Distribute Parasitical and Predaceous Insects.

Salary of George Compere (paid) from July 15, 1899, to March 31, 1901, 20½ months at $125	$2,562 50
Receipt July 17, 1899, by George Compere (expenses)	2,000 00
Receipt May 9, 1900, by George Compere (expenses)	502 50
Cable November 12, 1900, for (expenses)	500 00
Cable, March 27, 1901, for (expenses)	270 00
Draft for $500 sent to Yokohama to George Compere, October 25, 1900. Did not reach him in time, was returned with charge of	7 50
Receipts for expenditures charged to this account	60 83
Postage	200 00
George Compere, balance paid	483 50
Expenditures for which no vouchers can be found	913 17
	$7,500 00
Appropriation	$7,500 00

Expenditures of the Appropriation for Printing, Binding, Ruling, and All Other Work Performed and Materials Furnished by the State Printing Office to State Board of Horticulture.

Unexpended appropriation, fifty-first fiscal year	$1,000 00
Appropriation for fifty-second fiscal year	2,500 00
	$3,500 00
Expenditures, fifty-second fiscal year	3,500 00
Balance	None.
Expenditures, fifty-third fiscal year ending June 30, 1902	$2,500 00
Expenditures under Act of February 28, 1901	$1,895 99
Unexpended balance	30 01
Total	$1,926 00

Respectfully submitted.

J. J. KEEGAN,
Secretary and Chief Horticultural Officer.

REVIEW OF THE FRUIT SEASONS.

The seasons of 1901 and 1902 have both been good ones for the fruit-growers, so far as productiveness is concerned. There had been no serious pests in the orange sections, and the year 1901 opened with heavy shipments of citrus fruit, which increased in volume as the season advanced and continued so late in the season that the new and the old crops were being shipped at the same time and there was no well-defined break between the two orange seasons; but for the sake of reference the new season is presumed to commence on the first of November.

There was a fairly good output of deciduous fruits, although much damage was done by early April frosts, which killed off much young fruit and severely injured blooming trees. Cherries and apricots especially suffered, while in some sections peaches were badly injured. The greatest damage, however, was confined to a comparatively limited area, and the shipments of fresh deciduous fruits for the season exceeded 170,000,000 pounds.

In some sections grapes were injured by late frosts, which caught them in full bloom; and some sections reported almost a total loss of crop from this cause.

Apples turned out unusually well all over the State, shipments from the Pajaro Valley being the largest on record. A shortage in the Eastern crop had made a heavy demand for Pacific Coast fruit, which was shipped in large quantities to the East and to Europe.

The olive crop over the whole State was phenomenally heavy, the largest crop in the history of that fruit in California having been produced.

Prunes fell below normal in quantity. A succession of dry years in the Santa Clara Valley, which is the center of the prune industry, had the effect of lowering the water table in the land, leaving the roots dry in many cases and the trees with insufficient moisture. As a result, many trees died and many more bore a light crop of inferior fruit.

THE SEASON OF 1902.

The season of 1902 opened under more favorable auspices. Seasonal rains had been abundant, orchards were generally in good condition, and there was every promise of the heavy fruit crop that was realized later in the season.

The orange crop of the northern counties had all been marketed before the opening of the year, and heavy shipments were going forward from the southern counties. A severe north wind in the latter part of December did an immense amount of damage in the orange groves of the south, some reports stating that the loss of fruit amounted to nearly one third of the crop. This, with other unfavorable climatic conditions, resulted in a heavy falling off in orange shipments this year as compared with those of last season. Winter irrigation in this section was very generally followed. Several dry seasons in succession taught the fruit-growers to take advantage of all the water they could secure and to fill up the land in the winter as a precautionary measure against another season of short rainfall.

The State was unusually free from killing frosts during the last winter and entirely escaped them in the spring. A destructive frost is generally expected from the 1st to the 20th of April, when the deciduous trees are in bloom. If not too severe, this serves to remove the redundant bloom and is often regarded as beneficial rather than injurious; but, if too severe, it may very materially shorten the fruit crop and the income of the orchardist. This season we escaped this visitation entirely, and as a result the crop of deciduous fruits was one of the heaviest on record in the State. Another climatic condition favorable to the fruit crop was the cool weather in the latter part of January and through the month of February. Warm weather, so common in February, starts the sap flowing and forces the early blooming of deciduous trees, rendering them extremely sensitive to a later cold snap. This year we fortunately escaped both the warm weather of February and the frosts of April.

Cherries.—Owing to the cool weather in the early part of the season, fruit shipments this year were from two to three weeks later than usual, and the first shipment of cherries was made from Vacaville on April 25th by Frank H. Buck, who consigned the fruit to Porter Brothers, Chicago.

The first shipment of cherries usually consists of a ten-pound box, but this year, notwithstanding the lateness of the season, it was difficult to find even that quantity, and a three-pound box was forwarded, for the ripening process, though late, had begun. The three-pound box was sold in Chicago on Tuesday, April 29th, for the sum of $3—a dollar a pound, the usual price for the first cherries in that market.

This shipment was soon followed by larger ones, and early in May cherries began to go forward in carload lots. The first full carload from the Santa Clara Valley went forward on May 26th, fully two weeks later than in a normal season.

The crop was an exceptionally heavy one, one of the heaviest, in fact, ever produced in the State. A very large part of the crop went to the canneries, while 245.75 carloads were shipped to the Eastern market, against 98.50 cars for 1901—an increase of 147.25 carloads.

The first shipment of cherries from this State in 1901 went forward on April 11th; in the year 1900, on April 9th; in 1899, on March 31st; in 1898, on April 15th; in 1897, on April 26th; and in 1896, on April 12th; all from Vacaville.

Apricots.—Early reports from the apricot sections were conflicting. A heavy rain during the blooming season, it was claimed, had washed the pollen out of the blossoms, and that, in consequence, the fruit had not set well and the crop would be light. From other sections it was reported that the fruit was setting so thick that vigorous thinning would be needed to insure a crop of marketable sizes. The result has been a very good crop in nearly all sections, and in most localities severe thinning was necessary. In Southern California the apricot crop was one of the heaviest on record. Apricots appeared in the market late in May, and Eastern shipments soon followed, some small express shipments being made during the first week in June. By the middle of June the rush of Eastern shipments was on, and continued until the season was over, by which time 221.75 cars had been shipped, against 177.50 for the preceding year—a gain of 44.25 cars. A very large percentage of the crop was dried, although much of it was used by the canneries. The crop was so large that the canners advanced their standard and would accept nothing but the best fruit, no inferior fruit having been put up this year.

Pears have been a good average crop in all the counties north of the middle of the State. Below that line, pear-blight has wrought such destruction in the orchards as to practically remove the pear from further consideration. Fortunately this destructive disease has not yet obtained a foothold in our principal pear-growing districts, and therefore the losses in the affected districts do not materially influence the general result. The crop has been a good one, the fruit of superior quality, and Eastern shipments have been heavy, footing up 1,856.25 cars, against 1,475.75 cars for 1901. Prices for the fruit ranged very low during the season, and as a result very much of it found its way to the drying-grounds.

Apples have not been a full crop. There was a very material shortage in the Pajaro Valley and at Lompoc, while few, if any, of the apple sections have reported a full crop. Greater care has been exercised this season, by both pear and apple growers, in fighting fruit pests, especially the codling-moth, and as a result, this fruit has been more free from worms and of better quality. Eastern shipments up to the present writing have fallen off from last year, being, to September 30th, 116.75 carloads, against 173.75 for last year—a decrease of 57 cars. The bulk of the fruit yet remains to be shipped, and large quantities will continue to go forward for several months to come. The Pajaro Bellefleur crop is not running to small sizes. Four-tier stock is general, and even larger sizes in quantity. The crop is not going to show as many carloads as last year, notwithstanding the number of young trees in bearing for the first time this year. A conservative packer, whose estimates have come very close to crop results, says that the Bellefleur crop will not run much, if any, over 500 carloads of good merchantable stock, suitable for trade out of the State. Last year the shipments of Bellefleur apples out of the State aggregated 650 carloads.

Peaches have been at least a full average crop, running to large sizes. In many of the peach sections the trees were so heavily loaded early in the season that vigorous thinning was necessary to insure fruit up to the standard of the canneries. In some sections, the peach-moth (*Anarsia lineatella*) was more than usually destructive, and wormy peaches were common. There was a good demand for peaches at the canneries and a large pack has been put up. Eastern shipments have fallen somewhat under those of last year, being 1,757.2 cars, against 1,889.25 cars for the preceding year—a falling off of 132 cars up to October 1st.

Grapes have been somewhat spotted, but as a rule the crop has been a good one and some sections report it as very heavy. In some districts phylloxera and the Anaheim disease are reported, and where these pests obtain the output has been materially affected. In the raisin districts the output has been a full average. There has been a very active demand for wine grapes this season, and this, combined with the low price of raisins and the scarcity of labor, has had the effect of sending large quantities of raisin grapes to the wineries, and it is probable that the season's pack will fall below normal.

Prunes have turned out a much larger crop this year than in 1901, and from most sections they have been reported as a very heavy crop. In the Santa Clara Valley, however, which produces the great bulk of the prune crop, the yield has been below normal, and runs very much to small sizes. On the dry lands very many trees have died out during the last four years from insufficient rainfall, and a much larger number have been affected thereby. Prices for cured prunes have opened up very low, and the present outlook for this fruit is not encouraging.

The Fig.—The successful introduction of the *Blastophaga*, or fig-fertilizing insect, promises to revolutionize the fig industry of this State and to make an opening for a new and important branch of horticulture here. After many years of effort and the expenditure of vast sums of money, the fig wasp is now thoroughly established, has been carried through several seasons, and may be regarded as completely acclimatized. Smyrna figs are being successfully produced in commercial quantities and are being shipped in bulk for the first time in our history. Large plantings of these figs have been made in different parts of our State, and in a few years the fig of commerce will take its place with other fruits in the export list of California productions. The greater part of the credit for this is due to the indefatigable labors and liberal expenditures of George C. Roeding, to whose efforts we also owe the successful introduction of this insect.

Almonds have produced a very good crop in most sections. The absence of frost in the late spring months, when the fruit was setting, was very favorable for a crop of these nuts, and the yield from most orchards was reported as being from fair to very good.

Walnuts have done better this year than they did last, and a good crop was reported, especially from the southern counties. The brown spot of the walnut, which damaged a large percentage of the crop in 1901, has not been so prevalent this year, and while some nuts have been injured by it, the crop as a whole may be classed as a good one of superior quality.

Small Fruits, Berries, etc., have yielded very heavily, and an unusually heavy pack of all varieties has been put up by the canneries during the past season.

Taking the season as a whole, it may be said that it has been one of the best fruit years ever known in California. There have been drawbacks in some localities; some kinds of fruit in spots have not come up to the average; but, taken altogether, the fruit-growers of California have little complaint to make of the season just passed, so far as crops are concerned.

MOVEMENTS OF FRUITS.

Fresh Deciduous Fruits.—Shipments of fresh fruit out of the State up to November 5th of this year, exceeded those of 1901 by 823 carloads, although the shipping season was nearly three weeks later in starting than was that of the preceding year. Shipments for the present season as compared with the preceding year, according to the California Fruit-Grower, are as follows:

Shipments of California Deciduous Fruits East—Seasons of 1901 and 1902 to November 5th.

Deciduous Fruits.	1901.	1902.
	Cars.	*Cars.*
Cherries	98½	245¾
Apricots	177½	221¾
Peaches	1,892½	1,777
Plums	977¼	1,480¼
Pears	1,535¼	2,003
Grapes	944	970¾
Apples	540¾	309½
Mixed	39¼	20
Totals	6,205	7,028

Itemized Fresh Deciduous Fruit Shipments.

From north of Tehachapi only. In carloads. To December 1.

Destination.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
New York	862	1,055	1,456	1,430	1,694	1,527	1,482
Chicago	1,473	1,007	1,410	1,203	1,060	1,101	1,273
Boston	279	471	543	536	710	649	639
Philadelphia	82	90	202	176	339	212	257
Minneapolis	124	147	180	167	247	302	275
Omaha	176	85	165	156	194	240	205
St. Paul	109	91	121	67	125	131	108
Montreal	44	81	98	96	128	126	128
Denver	148	136	98	229	269	233	246
Kansas City	91	81	86	116	165	129	85
New Orleans	75	85	81	62	126	136	118
St. Louis	78	68	59	27	115	79	64
Milwaukee	42	32	52	19	60	68	62
Pittsburg	26	25	40	47	137	144	167
Cleveland	29	10	73	25	83	63	58
Cincinnati	15	2	20	15	89	35	29
Baltimore	37	5	16	16	67	34	23
Buffalo	15	7	15	5	34	10	32
England and Scotland	--------	42	58	42	121	199	93
Germany	--------	--------	--------	--------	2	--------	16
Mexico	--------	--------	--------	1	1	--------	--------
Other points	863	532	586	572	1,103	1,017	1,098
Totals	4,568	4,052	5,323	5,007	6,869	6,435	6,459

Varieties of Fruit Shipped.

In carloads.

Variety.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Pears	1,187	1,624	1,640	1,595	1,684	2,115	1,535
Peaches	1,289	976	1,316	1,103	2,625	1,361	1,901
Grapes	1,010	712	1,100	734	847	825	966
Plums and prunes	465	407	742	542	885	1,158	936
Cherries	180	88	239	297	85	238	110
Apricots	162	172	177	123	90	152	201
Apples	105	53	61	596	490	512	739
Quinces	13	8	24	1	19	10	13
Nectarines	5	1	10	--------	2	--------	2
Figs	--------	2	3	--------	--------	--------	--------
Persimmons	--------	--------	2	1	1	3	2
Mixed	152	9	9	15	24	27	23
Cars not reported	--------	--------	--------	--------	117	34	31
Totals	4,568	4,052	5,323	5,007	6,869	6,435	6,459

The fresh fruit season of 1901 was a remarkable one. While the crop was not large, growers did well, owing to fair crops, uniformly high prices in the East, greatly improved transportation facilities, and a reduction in the charges for refrigeration which became effective on April 15th.

Interstate Shipments of Fresh Deciduous Fruits.

	Pounds.
1890	74,646,000
1891	98,680,000
1892	111,689,000
1893	159,900,000
1894	179,576,000
1895	132,587,000
1896	115,300,000
1897	145,250,000
1898	139,550,000
1899	193,900,000
1900	182,375,000
1901	187,346,000
1902 (estimated)	192,000,000

Citrus Fruits.—Shipments of citrus fruits have fallen off as compared with former years, the total being 24,900 carloads for 1900–01 and 19,180 carloads for 1901–02—a falling off of 5,720 carloads. The conditions of the present year promise a much larger crop than the last, although it will not probably reach the phenomenal figures of 1901. Experts who have carefully examined the citrus fields estimate the new crop of citrus fruits at 20,000 carloads. For the season November 1, 1900, to October 31, 1901, there was a movement of 24,900 cars of citrus fruits, or 8,964,000 boxes, of which about 3,200 cars, or 992,000 boxes, were lemons.

California Orange and Lemon Crop.

Season.	Carloads.	Boxes.
1892–93	5,871	1,972,500
1893–94	5,022	1,687,500
1894–95	7,575	2,545,200
1895–96	6,915	2,323,500
1896–97	7,350	2,469,600
1897–98	15,400	5,174,400
1898–99	10,875	3,654,000
1899–00	18,400	6,624,000
1900–01	24,900	8,964,000
1901–02	19,180	6,904,800

That there is yet an unsupplied home market for much citrus fruit is shown from the fact that in 1901–02 we imported 52,742,476 pounds of oranges, valued at $784,640, and 164,182,952 pounds of lemons, worth $3,327,781. The following table gives the importations of these principal citrus fruits from 1895–96; prior to 1899–00 values only were available:

Receipts of Foreign Oranges and Lemons.

Season.	Oranges.		Lemons.	
	Pounds.	Value.	Pounds.	Value.
1895–96		$2,694,131		$5,040,344
1896–97		2,324,907		4,043,822
1897–98		886,722		2,848,130
1898–99		1,097,596		4,398,004
1899–00	68,618,818	1,087,041	160,197,966	3,666,881
1900–01	50,332,914	716,457	148,514,614	3,516,850
1901–02	52,742,476	784,640	164,182,952	3,327,781

Prunes.—The California prune holds its place in the front ranks of the fruit products and exports of the State. It has had many vicissitudes in the past few years, and especially in the past two seasons; owing to these unfavorable conditions, the total output has fallen off somewhat, but it remains one of the most important factors in the wealth-producing products of the State. The growth of the industry has taken place within the past thirty-five years, the first shipment of dried prunes having been made from San José in 1867. From that period it grew steadily, until it reached its maximum in 1900, when 174,000,000 pounds were produced. The production by years from 1890 is given below:

Prune Yield of California.

	Pounds.
1890	16,000,000
1891	27,500,000
1892	22,500,000
1893	52,180,000
1894	44,750,000
1895	64,750,000
1896	55,200,000
1897	97,780,000
1898	90,420,000
1899	114,227,000
1900	174,000,000
1901	81,600,000
1902 (estimated)	160,000,000

With our enormous output it became necessary to find a wider market for our fruits, and we have invaded Europe, sending our fruit even to France and Germany, the home of the prune, where large quantities have been sold in the past few years, and where this fruit is continually growing in favor, owing to its superior quality. Since 1897 we have exported prunes as follows:

Quantity and Value of Exports of Prunes.

Fiscal Year.	Pounds.	Value.
1897–98	15,940,791	$1,021,888
1898–99	5,615,565	380,847
1899–00	25,922,371	1,646,332
1900–01	10,021,564	589,113
1901–02	23,358,849	1,404,422

Quantity and Value of Foreign Prunes Imported.

Fiscal Year.	Pounds.	Value.
1890–91	34,281,322	$2,054,486
1891–92	10,869,797	437,271
1892–93	26,414,112	1,162,318
1893–94	9,908,122	416,342
1894–95	14,352,057	527,625
1895–96	483,658	68,862
1896–97	710,020	73,303
1897–98	303,992	39,660
1898–99	600,360	63,574
1899–00	443,457	47,700
1900–01	745,974	62,880
1901–02	522,478	44,077

Raisins.—The raisin pack has fallen off during the past two years, owing largely to low prices and dullness of the market. From these causes the fruit has been forced into another channel, and very much that should have gone onto the drying-trays has found its way to the winery and distillery. Another reason for the shortage in the pack this season will be found in the scarcity of labor. During the picking and drying period it was impossible to secure help to handle the crop, and much of it was rushed to the wineries in order to save it. The raisin pack reached its maximum in 1894, when 103,000,000 pounds were cured. This figure has never since been reached. The figures for the output of the past ten years are given below:

California Raisin Pack.

	Pounds.
1892	57,000,000
1893	85,000,000
1894	103,000,000
1895	91,360,000
1896	68,250,600
1897	93,704,000
1898	80,631,000
1899	71,568,000
1900	94,325,000
1901	74,000,000
1902 (estimated)	100,000,000

The importations and exports have been as follows:

Quantity and Value of Raisins Exported.

Fiscal Year.	Pounds.	Value.
1897–98	3,109,639	$167,062
1898–99	4,659,807	242,620
1899–00	2,415,456	139,689
1900–01	3,530,164	218,715
1901–02	2,323,274	149,216

Quantity and Value of Raisins Imported.

Fiscal Year.	Pounds.	Value.
1892–93	27,543,563	$1,266,342
1893–94	13,751,050	554,081
1894–95	15,921,278	651,420
1895–96	10,826,094	460,200
1896–97	12,650,598	567,039
1897–98	6,593,833	381,889
1898–99	4,933,201	282,400
1899–00	10,309,498	531,124
1900–01	3,860,876	297,631
1901–02	6,563,302	392,551

The Fig.—While we may look for a great increase in the fig pack of the future, due to the introduction of the *Blastophaga grosorum* by George C. Roeding, fig production in the past has not been an insignificant part of our fruit industry, as will be seen from the following table.

These figs include the California blacks, white Adriatics, and other inferior drying varieties:

California Cured Fig Output.

	Pounds.
1891	360,000
1892	500,000
1893	900,000
1894	1,540,000
1895	2,750,000
1896	2,160,000
1897	3,250,000
1898	4,780,000
1899	5,800,000
1900	6,000,000
1901	6,500,000
1902 (estimated)	7,250,000

The importation of Smyrna figs, which we hope soon to be able to replace with our California product, as will be seen from the subjoined table, is an item of considerable importance; of the figs imported, Asiatic Turkey sends us an average of 70 per cent. About 21 per cent of the imports of this fruit come from the United Kingdom, taking the average of the past five years, most of which, however, is of Turkish production.

Quantity and Value of Figs Imported.

Fiscal Year.	Pounds.	Value.
1890–91	9,201,565	$697,562
1891–92	8,338,759	511,142
1892–93	10,503,928	548,995
1893–94	7,985,959	393,040
1894–95	11,855,890	587,420
1895–96	11,900,710	639,512
1896–97	8,940,762	535,380
1897–98	9,628,426	509,002
1898–99	7,284,058	356,762
1899–00	8,812,487	513,895
1900–01	9,933,871	458,513
1901–02	11,087,131	487,733

Apples.—A steadily growing interest is being manifested in the apple, which has practically sprung into prominence in the past few years. It was always conceded that there were sections in this State where good apples could be grown, but this fruit was relegated to the background as a commercial proposition. Recent years, however, have demonstrated the fact that there are vast areas of good apple land in California, combined with climatic conditions suitable to the growth of that fruit, and the industry has forged ahead, until to-day apples count as an important item in our fruit exports. The fact that nearly one half the apple trees in this State are not yet of bearing age indicates the extent to which apple-planting has been followed in the past few years. There are now in orchard in California 2,120,595 apple trees, of which 1,586,241 are in bearing and 534,354 are not. Allowing 48 trees to acre, the usual number of apple trees, and we have 44,179 acres in apples. It would be perfectly safe to add 10 per cent to these figures, as there are many small orchards which escape notice. California is now an important shipper of apples, the larger part going from the Pajaro Valley and finding their way to the Eastern States and Europe. Large shipments are also made to China, Japan, Australia, Hawaii, the South Sea Islands, and South America.

Pajaro Valley Apple Shipments.

State, Interstate, and Export.

Season.	Cars.	Boxes.
1897–98	765	512,550
1898–99	953	638,510
1899–00	1,300	871,000
1900–01	1,500	960,000
1901–02	2,200	1,408,000

Exports of California Apples.

(In boxes.)

New York to—	1899–00.	1900–01.	1901–02.
Liverpool	58,922	61,602	109,715
London	70,724	107.752	153,653
Glasgow	13,118	22,415	20,449
Hull	4,826	7,000	9,681
Hamburg	1,925	1,325	2,929
Totals	149,515	200,094	296,427

Nuts.—The two principal nut crops of California are walnuts and almonds, and while most species of nuts are produced here in greater or less quantities, these alone are grown in quantities of commercial importance, and of these the walnut heads the list. The output of walnuts in this State since 1895 is shown in the following table:

California Walnut Production.

	Pounds.
1895	6,770,000
1896	12,400,000
1897	9,620,000
1898	12,200,000
1899	15,800,000
1900	16,340,000
1901	13,800,000
1902 (estimated)	17,500,000

Almond and Walnut Production, by Carloads.

	Almonds.	Walnuts.
1898	45 cars	565 cars.
1899	232 cars	558 cars.
1900	274 cars	543 cars.
1901	150 cars	690 cars.
1902 (estimated)	380 cars	875 cars.

Value of Imported Nuts.

Fiscal Year.	Almonds.	All Other.	Totals.
1894-95	$810,439 00	$1,202,405 00	$2,012,844 00
1895-96	763,594 00	1,311,570 00	2,075,164 00
1896-97	880,263 00	1,319,898 00	2,200,161 00
1897-98	659,659 00	1,578,279 00	2,237,938 00
1898-99	1,222,587 00	1,504,955 00	2,727,542 00
1899-00	949,083 00	2,029,751 00	2,978,834 00
1900-01	946,138 00	2,322,463 00	3,268,592 00
1901-02	1,240,886 00	2,803,333 00	4,044,219 00

Dried Fruits.—The dried fruit pack of the State this season was above normal. This is accounted for by the unusually large crop of apricots, peaches, and pears, the low prices offered by the canneries and the exacting demands made by them for fruit of the highest grade only, and the risk attendant upon shipping fresh fruit to the Eastern market. In consequence, more than the usual quantity went to the drying-grounds. The great scarcity of labor during the curing season militated somewhat against the dried fruit pack, or it would have been still heavier. The following table gives the quantity of dried fruit put up in California, by years. Prunes and raisins are not included in this table, as they are treated of under a separate head elsewhere:

Table of the Dried Fruit Output.

	Pounds.
1891	40,210,000
1892	38,200,000
1893	40,840,000
1894	81,720,000
1895	57,960,000
1896	42,775,000
1897	79,110,000
1898	37,400,000
1899	68,500,000
1900	94,580,000
1901	69,225,000

California Dried Fruit Output, by Varieties.
(In pounds.)

Varieties.	1898.	1899.	1900.	1901.
Peaches	10,960,000	34,800,000	34,340,000	29,500,000
Apricots	8,240,000	11,600,000	28,080,000	15,750,000
Apples	3,520,000	5,900,000	6,360,000	6,450,000
Figs	4,780,000	5,800,000	6,000,000	6,500,000
Pears	6,620,000	5,760,000	14,550,000	6,575,000
Plums	2,460,000	3,360,000	3,900,000	3,450,000
Nectarines	180,000	840,000	870,000	650,000
Grapes	640,000	440,000	480,000	350,000
Totals	37,400,000	68,500,000	94,580,000	69,225,000

Canned Fruits.—The season's pack of canned fruits is very heavy and of exceptional quality. The crop of canning fruit was an unusually heavy one, more, in fact, than the canneries could handle, and only the higher grades were accepted. The pack as a whole would have been much heavier had it not been for the great difficulty of securing labor to handle it in the ripening season. Some difficulty was also experienced in getting cans earlier in the season, but this was afterward overcome.

California Canned Fruit Pack.

	Cases.
1890	1,495,300
1891	1,571,200
1892	1,602,370
1893	1,001,640
1894	1,528,815
1895	1,639,807
1896	1,602,446
1897	1,942,982
1898	2,085,166
1899	3,003,171
1900	2,775,896
1901	2,677,072
1902 (estimated)	2,141,657

California Fruit and Vegetable Pack, by Varieties.

	In Cases		
Variety.	1899.	1900.	1901.
Apples	36,655	17,635	15,972
Apricots	722,272	537,091	294,896
Blackberries	23,129	17,040	21,750
Cherries—Royal Ann	------	75,472	28,178
Cherries—Black	6,498	28,827	12,136
Cherries—White	30,434	48,164	11,441
Currants	1,266	614	794
Gooseberries	1,165	1,592	1,371
Grapes	41,776	36,142	41,364
Nectarines	736	765	509
Pears	508,106	611,247	458,305
Peaches—Free	993,124	444,847	559,500
Peaches—Cling		462,121	801,788
Plums	137,413	163,266	137,191
Quinces	712	1,269	749
Raspberries	5,784	1,549	3,555
Strawberries	11,435	7,921	15,782
Total table fruits	2,520,505	2,455,562	2,405,181
Pie fruit, 2½-lb. cases	212,664	110,992	31,817
Pie fruit, gallon cases	216,307	153,236	200,492
Jams and jellies	53,695	56,106	39,582
Total fruits	3,003,171	2,775,896	2,677,072
Tomatoes, 2½-lb. cases	568,061	519,502	704,795
Tomatoes, gallon cases		47,048	43,645
Peas	25,966	57,466	102,089
Asparagus	105,881	143,861	187,592
Beans and other vegetables	38,523	35,740	37,937
Total fruits and vegetables	3,756,602	3,579,513	3,753,130

Exports of California Canned Fruits.

(From San Francisco by sea to England.)

Pack of.	Cases.
1895	272,890
1896	269,779
1897	339,018
1898	462,621
1899	611,382
1900	701,006
1901	131,184
1902 (to Oct. 20)	186,744

Olives.—The olive crop of 1901–02 was a phenomenal one. For many years there have been numerous complaints of the shyness of the olive as a bearer in most sections, but in all sections last season the olive endeavored to compensate for its shortcomings. It was the heaviest crop ever produced in the State, and the pack of both oil and pickles was exceptionally heavy. A great deal of damage has been done to the market for ripe pickled olives, through the efforts of unscrupulous parties to substitute dyed green olives. The pickling of ripe olives requires more care and attention than does the pickling of green fruit; but the superior flavor and food qualities of the former have rapidly brought them into favor. To meet the demand and at the same time avoid the extra care required in preparing the ripe fruit, some packers used dye-stuffs to color their inferior fruit and give it an attractive appearance. The fraud was detected, owing to the effect of the chemicals upon the persons who ate the fruit and who were sickened and injured by it. The parties perpetrating the fraud were arrested, severely punished, and the pratice nipped in the bud. Unfortunately, the notoriety given to the ripe pickled olive by it has had its effect, from which it will take some time to recover. The Los Angeles Times of April 6, 1902, gives the following account of this matter of dyeing olives:

> A stir was made yesterday when the attention of the Los Angeles Health Office was called to some very black pickled olives that had been purchased at the store of Adams & Hellinghausen, on Broadway. The paper bag in which the olives had been carried to the office was stained a vivid green wherever it had been touched by an olive. The tongue and lips of persons who attempted to eat of them, became swollen and inflamed, and remained in that condition for hours afterward.
>
> The olives were of an even, almost black color, on the outside, and when cut showed dark purple under the skin, and then bright green half way to the seed. They had been taken green from the tree and submitted to some sort of a dyeing process to give them the appearance of ripe olives.
>
> E. T. Morris, who lives at No. 232 South Hill street, bought some of these olives on Friday. He ate two of them himself, his little boy ate three, and Mrs. Morris ate one. The unpleasant effect on the mouth was at once apparent, and then the membrane became swollen and inflamed, and Mr. Morris and his family all became sick and greatly alarmed. Remedies were at once applied to Mrs. Morris and the boy, but the head of the family thought he would "grin and bear it," to see what the outcome would be. He suffered all night, as with cholera morbus, and none of them were fully recovered from the effects yesterday, when he decided to report to the authorities.
>
> Mr. Morris's experience was doubly aggravating to him, for the reason that he had been the special champion of California olives. Four years ago, while living here, he

sent back to his friends in New York a dozen bottles of ripe olives, because ripe olives were a novelty to them. They were delighted, and now on his return to this city, Mr. Morris wanted to be real nice to a couple of these same friends, so he went and purchased some of these same black olives and sent them by express to New York.

Imagine his chagrin, when yesterday, with his lips still swollen and his stomach still in a state of agitation from his own experience, he received a letter from one of his friends, worded as follows:

"Thank you very much for the olives, but the next time send the olives in their natural state, and we'll blue them ourselves."

Mr. Hellinghausen, in the presence of his partner, and speaking for the firm, said to a Times reporter:

"When we bought these olives from Hill & Sons they were sold to us for ripe olives, but after a customer or two had sent them back, I told Hill's agent that there was something wrong with them, and we wanted them to take them back."

In spite of this, however, they continued to sell them, for several weeks, and when Mr. Morris asked for olives on Friday he was in turn asked whether he would have light ones or dark ones, and, without trying them, he chose the latter.

A Times reporter called at the store, in company with Fruit Inspector Drummond, when the latter bought some of the olives in question, and an hour later he was informed that the barrel had been returned to the factory.

Mr. Cunningham, manager of the Hill establishment, said, when asked for an explanation:

"There were several packages of these olives on which we had been experimenting with coloring matter of a perfectly harmless nature. They were put out by accident, and when the discovery was made, steps were at once taken to get them back, and we were not aware that this package was still in the hands of Adams & Hellinghausen."

If there is any one thing that Southern California can not afford to do, it is to permit to go unexposed any tampering with her food products. The bleaching of dried fruits, the "dipping" of prunes, the slight coloring of certain products to make them appear more attractive in the package, may be looked upon as innocent tricks of the trade; but when it comes to changing the nature of the product by chemical treatment, which proves a menace to life, it is quite another thing.

The Health Office will make an analysis of the olives to discover, if possible, what was used in the coloring matter. It looks like aniline dye, and the effect on the membrane of the mouth is something not soon to be forgotten. Mr. Cunningham was asked if it was formalin, but he evaded the question and replied that it was a "perfectly harmless substance."

The lips of a Times reporter, who ate some of the poisoned olives, were badly blistered and remained so till an early hour this morning. Evidently the "perfectly harmless substance" has a stick in it.

The proprietors of Hill & Sons' factory say they were unaware that this experiment was being made, and that when they found out about it they severely reprimanded the experimenters.

Many small oil-makers complain of a lack of demand for their oils and find some difficulty in selling it. At the same time there is a large and unsupplied demand for oil in the United States, and the larger manufacturers have little trouble in securing a market for their output. In this, as in all branches of industry to-day, the small manufacturer is unable to push his wares into the market and is consequently at a disadvantage. The solution for this trouble will be in the combination of the small growers, the establishment of a central mill and factory, and the production of oil in sufficient quantity to warrant exploit-ing the market. That there is room for California oil is shown by the following figures of the importation of foreign oil:

Importation of Foreign Olive Oil Into the United States.

Fiscal Year.	Gallons.	Value.
1892–93	686,852	$891,424
1893–94	757,478	909,897
1894–95	775,046	952,405
1895–96	942,598	1,107,049
1896–97	928,567	1,134,077
1897–98	736,877	923,800
1898–99	930,042	1,090,254
1899–00	967,702	1,170,871
1900–01	983,059	1,266,293
1901–02	1,339,097	1,579,409

In his annual report to the State Board of Trade, General N. P. Chipman furnishes the following tables of the movements of California fruits. These tables are as nearly accurate as can be compiled, as the figures are obtained directly from the transportation companies. As the season of 1902 is not closed, figures for the present year, of course, are not available:

Shipments of Fruit Out of State in 1901.

Showing terminal points of shipment. Tons of 2,000 pounds.

Place of Shipment.	Green Decid'us	Citrus.	Dried.	Raisins.	Nuts.	Canned	All kinds.
Northern California.							
San Francisco	277.4	41.8	8,873.1	187.1	569.9	19,273.9	29,223.2
Oakland	2,029.2	.1	1,506.5	.2	24.5	6,332.6	9,893.1
San José	22,555.3	.1	41,944.6	8.0	476.6	6,889.3	71,873.9
Stockton	9,429.7	13,545.3	18,411.4	34,898.1	110.1	5,318.5	81,713.1
Sacramento	53,229.0	662.4	16,576.4	641.3	567.7	6,841.6	78,518.4
Marysville	2,207.3	4,225.8	8,708.0	79.7	121.9	3,987.9	19,330.6
Interior points not designated	573.0	2,317.1	3,635.0	5,679.0	--------	1,150.1	13,354.6
Total tons	90,300.9	20,792.6	99,655.0	41,493.4	1,870.7	49,793.9	303,906.5
Total carloads, ten tons ea.	9,030.1	2,079.3	9,965.5	4,149.3	187.1	4,979.4	30,390.7
Southern California.							
Los Angeles	175.3	183,294.3	4,098.8	562.1	5,227.1	4,864.4	198,222.0
Orange County	14.4	17,985.2	205.7	45.4	1,327.8	510.0	20,088.5
Riverside County	13.0	47,984.6	284.5	21.2	--------	--------	48,303.3
San Bernardino County	26.9	43,299.5	1,192.7	430.1	10.3	927.8	45,887.3
San Diego County	--------	10,423.5	67.8	538.1	--------	--------	11,029.4
Total tons	229.6	302,987.1	5,849.5	1,596.9	6,565.2	6,302.2	323,530.5
Total carloads, ten tons ea.	23.0	30,298.7	585.0	159.7	656.5	630.2	32,353.1
Total carloads by rail	9,053.1	32,378.0	10,550.5	4,309.0	843.6	5,609.6	62,743.8
Total carloads by sea	314.3	9.2	148.2	22.4	2.6	2,713.3	3,210.0
Total carloads from State by rail and sea	9,367.4	32,387.2	10,698.7	4,331.4	846.2	8,322.9	65,953.9

Shipments of Vegetables Out of State in 1901.

Tons of 2,000 pounds.

Place of Shipment.	Green Vegetables.	Canned Vegetables.	Place of Shipment.	Green Vegetables.	Canned Vegetables.
Northern California.			*Southern California.*		
San Francisco	20,442.8	555.8	Los Angeles	26,397.3	231.5
Oakland	784.1	3,230.2	Orange County	1,199.7	------
San José	982.1	1,432.2	Riverside County	7.9	------
Stockton	11,567.3	40.8	S. Bernardino Co.	132.7	------
Sacramento	9,794.8	1,972.5	San Diego County	15.0	------
Marysville	339.5	--------			
Other points not designated	4,591.8	--------			
Total tons	48,502.4	7,231.5	Total tons	27,752.6	231.5
Total carloads, ten tons each	4,850.2	723.1	Total carloads, ten tons each	2,775.3	23.1
Total carloads by rail				7,625.5	746.2
Total carloads by sea				783.2	17.9
Total carloads from State				8,408.7	764.1

Table of Gain—1900 and 1901 Compared.

Carloads of ten tons each.

Kinds.	1900.	1901.	Gain.
Green deciduous	9,117.7	9,367.4	249.7
Citrus fruits	22,654.6	32,387.2	9,732.6
Dried fruits	9,005.4	10,698.7	1,693.3
Raisins	3,604.6	4,331.4	726.8
Nuts	651.9	846.2	194.3
Canned fruits	7,555.6	8,322.9	767.3
Vegetables	5,140.7	9,172.8	4,032.1
Totals	66,797.8	83,731.9	17,396.1

GENERAL SUMMARY AND COMPARATIVE TABLES OF SHIPMENTS OUT OF STATE, BY RAIL AND BY SEA, OF FRUITS, WINE, BRANDY, AND VEGETABLES FOR TWELVE CONSECUTIVE YEARS. TONS OF 2,000 POUNDS.

Kinds.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Green deciduous	34,042.0	50,548.9	59,374.5	80,112.3	90,692.2	66,254.8	57,638.3	72,350.2	69,732.2	96,943.6	91,176.5	93,673.7
Citrus fruits	34,209.6	46,921.4	34,857.5	80,757.0	58,964.0	115,825.5	99,156.0	98,547.0	180,658.9	131,916.8	226,546.6	323,871.4
Dried fruits	32,297.5	32,919.0	29,762.2	45,386.2	51,828.2	61,386.4	48,522.8	75,159.7	76,662.7	86,925.3	90,052.8	106,987.1
Raisins	20,560.1	22,779.1	26,673.4	37,409.9	46,954.4	46,390.1	34,434.6	39,065.8	47,796.3	36,008.7	36,047.0	43,314.0
Nuts	787.1	1,358.9	2,061.9	1,796.5	3,953.5	3,234.7	4,972.6	5,808.6	5,815.8	6,608.4	6,518.4	8,462.4
Canned fruits	40,060.9	32,395.0	55,273.7	31,626.3	60,352.6	41,395.5	45,546.9	73,464.7	52,219.7	75,240.0	75,556.9	83,229.1
Carloads fruit, by rail and by sea	16,195.7	18,692.2	20,800.3	27,708.8	31,274.4	33,547.2	29,026.7	36,439.6	43,288.6	43,364.3	52,901.5	65,953.8
Carloads vegetables, by rail	*	*	*	6,978.4	4,276.6	3,613.6	1,130.6	4,243.8	3,045.6	2,613.6	4,367.8	8,371.7
Carloads vegetables, by sea	*	*	*	*	410.0	40.0	487.7	490.8	801.4	790.7	772.9	801.1
Carloads wine and brandy, by rail and sea	*	4,765.1	4,832.5	6,620.9	7,663.5	8,056.8	7,609.0	6,897.8	9,014.0	8,713.9	9,067.3	8,605.3
Carloads fruit, vegetables, wine, and brandy, by rail and sea	16,195.7	23,347.3	25,632.8	40,928.5	43,624.7	45,257.4	38,254.0	48,072.0	56,149.6	55,482.5	66,797.8	83,731.9

* None reported.

IMPORTATIONS OF FRUITS AND NUTS.

The value of fruit importations into the United States for the fiscal year 1901–02 was $17,436,306, and the total of fruit and nuts $21,480,525. A very large part of this was for tropical fruits which can not be grown profitably in California, but by far the greater part was for such fruits as are grown here. This is sufficient to show that there is still a market not reached by us for fruit and fruit products. Our exportation of fruit and nuts for the same year amounted to $8,719,344, leaving a balance against us of $2,761,178.

Quantity and Value of Fruits and Nuts Imported into United States during Fiscal Years 1900, 1901, and 1902, ending June 30th.

	1900.		1901.		1902.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Oranges	68,618,938	$1,087,041	50,332,914	$716,457	52,742,476	$784,640
Lemons	160,198,056	3,666,881	148,514,614	3,516,856	164,182,952	3,327,781
Figs	8,812,487	513,895	9,933,871	458,513	11,087,131	487,733
Currants	36,251,779	916,908	16,049,198	916,994	36,238,976	1,238,756
Dates	19,902,512	410,349	18,434,917	372,400	20,013,681	344,833
Raisins	10,309,498	531,124	3,860,836	297,631	6,563,302	392,551
Plums & Prunes	443,457	47,700	745,974	62,880	522,478	44,077
Almonds	6,317,633	949,083	5,140,232	946,138	9,868,982	1,240,886

The total value of nuts and fruits imported into the United States for the fiscal years ending June 30, 1900 and 1901, was $19,263,592 and $19,586,703, respectively. Of the fruits imported for 1901, Italy contributed larger imports than any other country, consignments worth $4,170,000 being received. Next to Italy the British West Indies were the most important source of supply, furnishing shipments to the value of $3,431,000. Other countries of leading importance in the trade were Spain, France, Costa Rica, and Honduras. Spain contributed $1,870,000 worth and France $1,521,000 worth. The imports from Costa Rica were valued at $1,297,000 and the imports from Honduras at $1,070,000. The value of fruits and nuts imported from the Philippine Islands during 1901 amounted to $4,858. The importations from Porto Rico during 1901 were: lemons, 707,251 pounds, valued at $8,824, and oranges, 4,790,369 pounds, valued at $60,876. The fruit shipments from Hawaii were valued at $75,000.

In order that a comparison may be made, a table is given below of the imports for 1892 and 1893. Although California has furnished an immense and constantly increasing quantity of the fruits and nuts enumerated, yet there is not as much of a decline in the imports of 1901 as might have been expected, proving that consumption has nearly kept pace with production and importation, and that there is yet a large and remunerative field in domestic markets to be supplied by home efforts:

Quantity and Value of Fruits and Nuts Imported Into United States during Fiscal Years 1892 and 1893, ending June 30th.

	1892.		1893.	
	Pounds.	Value.	Pounds.	Value.
Oranges	------------	$1,210,338	------------	$1,695,469
Lemons	------------	4,548,263	------------	4,994,328
Figs	8,338,759	511,142	10,503,928	548,995
Currants	36,665,828	1,209,119	33,166,546	1,185,537
Dates	17,084,557	551,629	16,211,906	493,910
Raisins	20,687,640	964,309	27,543,563	1,266,342
Plums and Prunes	10,869,797	437,271	26,414,112	1,162,318
Almonds	7,629,392	1,028,671	6,679,147	938,054
Other Nuts*	------------	821,200	------------	951,941

* Exclusive of cocoanuts.

The value of fruits exported in 1901 was as follows: Apples (dried), 28,877,085 pounds, valued at $1,648,410; apples (green or ripe), 779,980 barrels, valued at $1,753,988; oranges, $332,434; prunes, 14,375,073 pounds, valued at $909,545; raisins, 3,424,267 pounds, valued at $192,022; other green, ripe, or dried fruit, $2,323,304; canned fruits, $2,355,113; other preserved fruits, $65,545. Total, $9,263,339. The value of nuts exported (description not given), $160,544. Grand total of fruits and nuts, $9,423,883.

EXPORTS OF FRUIT AND NUTS FROM THE UNITED STATES DURING THE FIVE YEARS ENDED JUNE 30, 1902.

Articles Exported.	1898.		1899.		1900.		1901.		1902.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Fruits—										
Apples, dried (lbs.)	31,031,254	$1,897,725	19,305,739	$1,245,733	34,964,010	$2,247,851	28,309,023	$1,510,581	15,664,468	$1,190,593
Apples, green or ripe (bbls.)	605,390	1,684,717	380,222	1,210,459	526,636	1,444,655	883,673	2,058,964	459,719	1,628,886
Apricots, dried									1,928,367	178,143
Oranges		339,396		282,313		271,468		436,560		420,835
Prunes (lbs.)	15,940,791	1,021,888	5,615,565	380,847	25,922,371	1,646,332	10,021,564	589,113	23,358,849	1,404,422
Raisins (lbs.)	3,109,639	167,062	4,659,807	242,620	2,415,456	139,689	3,512,164	218,715	2,323,274	149,216
Other green, ripe, dried		2,033,845		1,997,649		2,545,451		2,716,269		2,153,050
Preserved—										
Canned		1,624,741		2,330,715		3,127,278		3,006,109		1,195,635
Other		82,504		66,899		63,448		71,597		94,323
Total fruits		$8,851,878		$7,757,235		$11,486,172		$10,607,908		$8,415,103
Nuts		161,432		140,250		156,490		218,743		304,241
Total fruits and nuts		$9,013,310		$7,897,485		$11,642,662		$10,826,651		$8,719,344

Included in the dried fruit shipments for 1901-02 were 1,928,367 pounds of apricots, valued at $178,143, which had not been segregated prior to this year.

FRUIT ACREAGE IN CALIFORNIA.

The number of trees in California, according to the last returns of the County Assessors, compiled by the State Board of Equalization, was 30,985,404, of which 23,389,919 were in bearing and 7,595,485 were non-bearing. Allowing 100 trees to the acre, this would give us 309,854 acres of land in fruit in the State. The assessor's figures are, as a rule, very unreliable, as many assessors fail to make proper returns, others make random estimates, while only a few make conscientious returns. Difficulties, also, are met with in making these returns. Many farmers are suspicious that the information is required for assessment purposes, and are unwilling to supply it, while others keep no systematic account of the number of their trees. It is safe, therefore, to add at least 10 per cent to the figures here given, which are the only ones available, and furnish an approximate idea of the extent of the fruit interests of the State.

Kind of Fruit.	Number of Trees in Bearing.	Number of Trees Non-Bearing.
Apple	1,586,241	534,354
Almond	1,160,750	278,622
Apricot	2,305,277	386,002
Cherry	409,325	116,409
Fig	149,360	46,338
Grape (acres)*	187,200	23,610
Lemons	805,263	504,622
Lime	1,220	--------
Nectarine	1,147	105
Orange	3,137,308	1,843,200
Olive	590,543	571,480
Peach	4,681,455	1,401,881
Pear	1,343,543	333,210
Plum	265	330
Pomelo	9,600	12,425
French Prune	6,249,955	1,132,287
Prune	625,205	246,287
Quince	1,425	105
Walnut	326,547	185,503
Miscellaneous	5,490	2,325
Total	23,389,919	7,595,485

Total, all kinds 30,985,404

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*Not included in totals.

NUMBER OF FRUIT TREES IN CALIFORNIA, BY COUNTIES.

As per Assessors' Returns, March, 1901.

COUNTIES.	APPLE.		APRICOT.		CHERRY.	
	Bearing.	Non-Bearing.	Bearing.	Non-Bearing.	Bearing.	Non-Bearing.
Alameda	54,000	1,500	102,000	8,000	78,300	20,200
Alpine	1,021	285	---------	---------	50	---------
Amador	4,540	1,075	1,554	---------	504	---------
Butte	8,175	---------	14,450	---------	9,600	---------
Calaveras	6,000	4,000	2,000	1,000	500	200
Colusa	3,500	1,020	27,475	43,000	1,000	300
Contra Costa	10,300	1,250	47,450	4,500	10,800	910
Del Norte	7,950	550	---------	---------	300	42
El Dorado	29,160	5,650	2,000	650	4,200	1,120
Fresno	18,640	6,420	53,500	35,000	1,146	354
Glenn	---------	9,000	---------	15,000	---------	1,000
Humboldt	---------	---------	---------	---------	---------	---------
Inyo	18,570	200	610	40	660	30
Kern	6,000	4,000	20,000	500	1,000	650
Kings	2,200	---------	19,780	2,000	---------	---------
Lake	18,965	---------	1,610	---------	755	---------
Lassen	39,650	---------	224	---------	652	---------
Los Angeles	25,665	18,230	78,655	28,250	50	1,180
Madera	825	---------	8,785	---------	10	---------
Marin	18,650	1,150	6,500	900	400	95
Mariposa	35,000	---------	700	---------	500	---------
Mendocino	83,128	16,195	325	187	328	207
Merced	1,800	670	6,510	4,017	920	450
Modoc	13,196	---------	433	---------	725	---------
Mono	---------	---------	---------	---------	---------	---------
Monterey	300,210	---------	7,200	---------	210	---------
Napa	48,250	16,480	1,645	12,530	4,160	12,100
Nevada	40,400	300	4,100	300	2,300	---------
Orange	8,514	6,220	80,045	53,251	---------	---------
Placer	24,300	7,425	11,240	4,350	12,785	6,740
Plumas	3,750	1,500	---------	---------	100	---------
Riverside	2,264	1,409	64,848	10,147	464	627
Sacramento	5,850	1,350	26,000	38,000	5,400	8,950
San Benito	9,500	---------	15,000	3,000	2,500	560
San Bernardino	10,000	3,500	60,000	3,000	8,000	3,000
San Diego	---------	---------	---------	---------	---------	---------
San Francisco	---------	---------	---------	---------	---------	---------
San Joaquin	1,410	975	81,483	17,600	4,006	3,720
San Luis Obispo	64,100	12,500	49,200	8,100	7,100	3,500
San Mateo	17,000	6,800	10,500	520	1,350	---------
Santa Barbara	15,880	9,740	11,780	3,610	---------	---------
Santa Clara	21,020	975	531,000	14,075	128,000	25,500
Santa Cruz	279,540	276,545	35,398	29,401	17,768	4,487
Shasta	---------	---------	---------	---------	---------	---------
Sierra	7,200	---------	20	---------	200	---------
Siskiyou	---------	---------	---------	---------	---------	---------
Solano	2,020	---------	308,610	---------	37,980	---------
Sonoma	170,160	71,320	14,700	2,660	29,960	13,240
Stanislaus	58	---------	151	---------	---------	---------
Sutter	4,830	---------	12,905	---------	3,595	---------
Tehama	17,490	1,360	52,385	4,720	3,700	1,490
Trinity	4,500	3,000	50	---------	210	240
Tulare	14,705	12,340	50,050	5,100	525	184
Tuolumne	3,650	5,020	2,250	560	3,005	365
Ventura	30,872	---------	341,679	---------	700	---------
Yolo	350	---------	75,000	---------	8,200	---------
Yuba	7,400	700	17,300	4,300	9,400	2,200
Totals	1,522,158	510,654	2,261,100	358,268	404,018	113,641

NUMBER OF FRUIT TREES IN CALIFORNIA, BY COUNTIES—Continued.

As per Assessors' Returns, March, 1901.

Counties.	Peach.		Pear.	
	Bearing.	Non-Bearing.	Bearing.	Non-Bearing.
Alameda	79,000	6,000	62,000	8,200
Alpine	---------	---------	110	40
Amador	13,185	375	4,869	---------
Butte	125,000	---------	20,425	---------
Calaveras	4,000	1,000	500	100
Colusa	25,000	15,000	20,022	15,200
Contra Costa	30,165	3,350	62,100	19,800
Del Norte	50	---------	650	250
El Dorado	125,900	21,600	60,000	35,100
Fresno	375,000	216,700	85,640	39,400
Glenn	---------	20,000	---------	15,000
Humboldt	---------	---------	---------	---------
Inyo	6,100	100	2,350	200
Kern	35,000	---------	15,000	---------
Kings	201,980	8,050	42,500	1,200
Lake	14,870	---------	19,830	---------
Lassen	721	---------	1,003	---------
Los Angeles	91,825	33,940	18,130	865
Madera	24,790	---------	2,120	---------
Marin	4,650	420	---------	---------
Mariposa	6,000	---------	3,000	---------
Mendocino	19,275	3,009	8,240	201
Merced	50,500	20,100	7,000	1,500
Modoc	409	---------	763	---------
Mono	---------	---------	---------	---------
Monterey	960	---------	1,400	---------
Napa	91,200	23,860	47,100	16,460
Nevada	9,400	1,200	26,000	500
Orange	16,843	27,141	3,285	1,845
Placer	633,400	510,690	98,400	26,495
Plumas	500	200	700	500
Riverside	26,350	5,953	14,264	2,821
Sacramento	123,000	42,000	65,000	60,000
San Benito	14,000	4,000	11,750	3,600
San Bernardino	75,000	4,000	5,000	1,000
San Diego	---------	---------	---------	---------
San Francisco	---------	---------	---------	---------
San Joaquin	75,621	18,211	15,826	3,940
San Luis Obispo	58,500	23,500	33,100	11,200
San Mateo	1,200	---------	4,000	---------
Santa Barbara	5,745	2,680	1,615	730
Santa Clara	487,030	55,510	120,150	18,820
Santa Cruz	20,929	1,566	21,006	3,513
Shasta	---------	---------	---------	---------
Sierra	400	---------	200	---------
Siskiyou	---------	---------	---------	---------
Solano	308,720	---------	203,250	---------
Sonoma	19,755	13,860	45,960	10,320
Stanislaus	163	74	47	---
Sutter	134,910	12,525	21,907	38,972
Tehama	566,250	131,130	43,500	14,900
Trinity	900	575	350	195
Tulare	340,364	47,628	21,724	2,345
Tuolumne	9,070	2,940	2,215	300
Ventura	43,970	---------	5,800	---------
Yolo	183,000	---------	48,000	---------
Yuba	71,000	29,260	17,225	2,700
Totals	4,552,400	1,308,147	1,315,026	358,212

NUMBER OF FRUIT TREES IN CALIFORNIA, BY COUNTIES—Continued.

As per Assessors' Returns, March, 1901.

Counties.	Prune (French).		Prune (Other).	
	Bearing.	Non-Bearing.	Bearing.	Non-Bearing.
Alameda	140,000	28,000	18,000	2,500
Alpine	-----	-----	200	-----
Amador	11,157	2,080	-----	-----
Butte	75,200	-----	8,115	-----
Calaveras	200	200	800	100
Colusa	75,000	50,000	1,300	1,800
Contra Costa	30,450	2,310	7,000	950
Del Norte	-----	-----	1,300	-----
El Dorado	26,000	1,110	8,430	2,110
Fresno	22,300	3,250	7,685	5,870
Glenn	-----	40,000	-----	5,000
Humboldt	-----	-----	-----	-----
Inyo	2,000	115	2,400	225
Kern	75,000	-----	1,000	-----
Kings	91,820	2,500	10,365	1,540
Lake	58,320	-----	2,750	-----
Lassen	940	-----	736	-----
Los Angeles	49,500	18,880	11,665	12,060
Madera	3,244	-----	-----	-----
Marin	-----	-----	1,800	1,085
Mariposa	1,500	-----	300	-----
Mendocino	47,222	30,875	2,214	1,007
Merced	17,200	5,000	2,150	680
Modoc	224	-----	929	-----
Mono	-----	-----	-----	-----
Monterey	17,200	-----	-----	-----
Napa	98,480	78,975	28,500	4,800
Nevada	1,800	-----	-----	-----
Orange	24,050	12,385	-----	-----
Placer	12,490	9,000	67,945	47,480
Plumas	-----	-----	-----	-----
Riverside	41,633	9,329	-----	-----
Sacramento	25,000	53,000	30,000	79,000
San Benito	74,810	5,000	6,300	-----
San Bernardino	20,000	10,000	-----	-----
San Diego	-----	-----	-----	-----
San Francisco	-----	-----	-----	-----
San Joaquin	45,209	18,700	13,740	12,600
San Luis Obispo	152,230	37,200	39,200	14,100
San Mateo	30,000	-----	-----	-----
Santa Barbara	1,445	420	1,970	410
Santa Clara	3,550,120	376,200	47,015	39,100
Santa Cruz	153,871	29,220	18,241	7,508
Shasta	-----	-----	-----	-----
Sierra	-----	-----	-----	-----
Siskiyou	-----	-----	-----	-----
Solano	255,990	-----	98,400	-----
Sonoma	360,970	155,270	38,240	6,870
Stanislaus	162	23	-----	-----
Sutter	2,500	-----	2,550	-----
Tehama	71,270	17,550	15,400	3,600
Trinity	550	505	250	190
Tulare	338,875	46,783	51,776	2,556
Tuolumne	-----	-----	275	170
Ventura	85,380	-----	-----	-----
Yolo	25,000	-----	70,000	-----
Yuba	17,900	3,890	3,175	375
Totals	6,134,212	1,047,770	622,116	253,686

NUMBER OF FRUIT TREES IN CALIFORNIA, BY COUNTIES—Continued.

As per Assessors' Returns, March, 1901.

COUNTIES.	FIG.		OLIVE.		ORANGE.	
	Bearing.	Non-Bearing.	Bearing.	Non-Bearing.	Bearing.	Non-Bearing.
Alameda	100	------	4,000	1,300	1,900	300
Amador	490	------	17	------	240	------
Butte	9,320	------	71,000	32,000	307,800	20,090
Calaveras	400	200	6,000	1,000	300	400
Colusa	3,000	2,000	700	500	800	950
Contra Costa	2,790	645	18,100	6,500	1,050	415
El Dorado	1,410	350	1,500	600	1,125	740
Fresno	32,300	4,600	15,420	35,800	20,740	17,560
Glenn	------	9,000	------	1,000	------	8,000
Inyo	50	------	------	------	------	------
Kern	1,000	------	4,700	------	3,500	------
Lake	1,660	------	2,365	------	50	------
Lassen	------	------	------	------	------	------
Los Angeles	2,785	1,605	13,310	173,270	579,585	273,080
Madera	6,394	------	1,160	------	186	------
Marin	190	60	------	------	300	100
Mariposa	1,000	------	9,000	------	600	------
Mendocino	65	18	15	250	------	------
Merced	5,718	1,000	24,019	2,000	3,450	450
Modoc	------	------	------	------	------	------
Monterey	------	------	------	------	------	------
Napa	1,460	430	32,400	22,340	2,990	140
Nevada	1,000	50	400	50	600	50
Orange	2,700	------	32,875	11,060	240,328	118,720
Placer	4,020	2,150	28,740	18,200	17,300	14,675
Riverside	2,126	57	23,814	37,861	772,899	380,642
Sacramento	1,300	2,600	11,050	6,000	20,000	21,000
San Benito	200	------	300	------	100	------
San Bernardino	3,000	1,500	20,000	1,500	750,000	600,000
San Joaquin	6,010	1,240	19,790	5,092	1,228	1,540
San Luis Obispo	2,140	1,000	2,580	800	2,850	1,410
San Mateo	100	------	7,000	500	108	------
Santa Barbara	------	------	19,940	14,260	1,510	740
Santa Clara	1,650	480	8,890	6,800	998	560
Santa Cruz	307	131	1,742	2,582	124	92
Solano	5,300	------	3,360	------	1,260	------
Sonoma	1,910	1,010	28,960	14,960	4,590	1,040
Stanislaus	44	------	108	23	62	3
Sutter	2,541	------	2,100	------	497	------
Tehama	9,840	1,075	10,490	87,472	1,690	4,562
Trinity	7	------	------	------	------	------
Tulare	5,907	1,542	4,186	3,745	205,595	295,956
Tuolumne	930	235	20	25	345	120
Ventura	2,383	------	85,307	------	66,485	------
Yolo	3,900	------	16,500	------	12,000	------
Yuba	5,003	1,650	7,600	1,675	32,600	29,360
Totals	132,450	34,628	539,458	489,165	3,057,785	1,792,695

NOTE.—No trees reported by assessor's returns for the following counties: Alpine, Del Norte, Humboldt, Kings, Mono, Plumas, San Diego, San Francisco, Shasta, Sierra, and Siskiyou.

NUMBER OF FRUIT TREES IN CALIFORNIA, BY COUNTIES—Continued.

As per Assessors' Returns, March, 1901.

COUNTIES.	LEMON.		ALMOND.		WALNUT.	
	Bearing.	Non-Bearing.	Bearing.	Non-Bearing.	Bearing.	Non-Bearing.
Alameda	900	300	65,000	25,000	1,400	900
Amador	5	----	2,357	----	77	----
Butte	1,220	----	25,375	----	965	----
Calaveras	50	50	1,000	500	400	300
Colusa	100	150	3,000	11,200	----	----
Contra Costa	330	150	130,300	50,000	2,450	1,975
El Dorado	210	----	2,200	870	480	140
Fresno	3,900	9,400	3,500	2,300	2,750	680
Glenn	----	2,500	----	5,000	----	----
Inyo	----	----	40	----	400	----
Kern	300	----	1,200	----	50	----
Lake	----	----	5,825	----	800	----
Lassen	----	----	36	----	208	----
Los Angeles	172,880	25,750	36,635	51,715	93,030	48,120
Madera	41	----	836	----	35	----
Marin	25	15	125	60	50	45
Mariposa	3,000	----	600	----	400	----
Mendocino	890	400	765	286	125	73
Merced	1,300	200	7,250	4,000	610	155
Modoc	----	----	----	----	51	----
Monterey	----	----	690	----	----	----
Napa	280	120	38,460	15,360	8,980	1,860
Nevada	300	50	800	75	1,300	300
Orange	24,780	52,548	----	----	94,610	73,650
Placer	500	490	3,200	2,450	1,240	960
Riverside	74,115	11,616	12,932	744	1,323	1,142
Sacramento	1,450	800	31,000	32,000	2,000	1,500
San Benito	----	----	7,000	----	400	1,500
San Bernardino	120,000	40,000	2,000	1,500	3,000	1,000
San Joaquin	446	275	126,757	40,312	720	570
San Luis Obispo	11,600	6,500	4,100	1,000	19,850	8,200
San Mateo	110	----	560	----	600	----
Santa Barbara	73,440	75,860	1,840	----	14,295	13,820
Santa Clara	379	620	15,210	4,065	8,905	2,560
Santa Cruz	94	41	407	61	1,566	4,430
Solano	280	----	97,390	----	600	----
Sonoma	510	430	2,260	1,390	2,240	2,070
Stanislaus	7	5	18	25	1	2
Sutter	68	----	33,730	1,744	1,045	----
Tehama	210	172	54,240	6,830	3,160	2,245
Trinity	----	----	5	----	75	25
Tulare	40,753	23,840	3,500	----	600	----
Tuolumne	110	100	305	45	845	850
Ventura	95,601	----	12,908	----	47,507	----
Yolo	1,400	----	412,000	----	----	----
Yuba	3,500	1,890	6,540	540	1,950	295
Totals	635,084	254,272	1,153,896	259,072	321,093	169,367

NOTE.—No trees reported by assessor's returns for the following counties: Alpine, Del Norte, Humboldt, Kings, Mono, Plumas, San Diego, San Francisco, Shasta, Sierra, and Siskiyou.

ACREAGE OF GRAPEVINES IN CALIFORNIA, BY COUNTIES.

As per Assessor's Returns, March, 1901.

COUNTIES.	TABLE.		RAISIN.		WINE.	
	Bearing.	Non-Bearing.	Bearing.	Non-Bearing.	Bearing.	Non-Bearing.
Alameda	100	----------	----------	----------	6,900	----------
Alpine	245	----------	----------	----------	----------	----------
Calaveras	50	50	25	10	1,200	500
Colusa	14	8	500	6	20	----------
Contra Costa	675	180	60	10	1,850	750
El Dorado	260	90	100	----------	1,000	----------
Fresno	795	235	41,630	3,400	25,345	4,350
Inyo	20	----------	47	----------	50	----------
Kern	100	----------	1,000	----------	----------	----------
Kings	----------	----------	6,000	350	----------	----------
Lake	500	----------	----------	----------	200	----------
Los Angeles	151	----------	14	----------	3,250	----------
Madera	308	----------	440	----------	710	----------
Marin	----------	----------	----------	----------	425	10
Mariposa	100	----------	100	----------	400	----------
Mendocino	825	700	35	10	460	880
Merced	520	150	950	350	625	248
Monterey	----------	----------	17	----------	----------	----------
Napa	----------	----------	----------	----------	3,000	----------
Nevada	200	20	----------	----------	300	----------
Orange	----------	----------	850	----------	----------	----------
Placer	840	----------	175	----------	290	----------
Riverside	42	----------	262	----------	18	----------
Sacramento	5,000	----------	800	----------	9,000	----------
San Benito	16	----------	----------	----------	171	----------
San Bernardino	----------	----------	7,000	2,000	2,500	3,000
San Joaquin	960	1,550	280	390	870	1,217
San Luis Obispo	1,650	190	----------	----------	800	200
San Mateo	----------	----------	----------	----------	235	----------
Santa Clara	537	----------	----------	----------	7,920	----------
Santa Cruz	559	----------	----------	----------	1,069	----------
Shasta	103	87	5	5	200	----------
Solano	318	----------	----------	----------	820	----------
Sonoma	270	90	----------	----------	12,080	2,370
Stanislaus	28	----------	183	----------	106	----------
Sutter	21	15	343	209	19	----------
Tehama	325	----------	309	----------	2,860	----------
Trinity	10	----------	----------	----------	----------	----------
Tulare	----------	----------	3,140	100	----------	----------
Tuolumne	305	230	----------	----------	1,520	210
Ventura	55	----------	146	----------	95	----------
Yolo	1,700	----------	8,000	----------	7,200	----------
Yuba	45	----------	110	----------	215	----------
Totals	17,647	3,595	72,521	6,840	93,723	13,735

NOTE.—No vines reported by assessors' returns for the following counties: Amador, Butte, Del Norte, Glenn, Humboldt, Lassen, Modoc, Mono, San Diego, Plumas, San Francisco, Santa Barbara Sierra, and Siskiyou.

FRUIT AND VEGETABLE CANNERIES IN CALIFORNIA.

Cannery.	Location.	Agent or Drier.
J. C. Ainsley Packing Co.	Campbell	J. C. Ainsley Packing Co.
Bendel-Nelson Co.	Gridley	Griffith-Durney Co.
California Canneries Co.	San Francisco	
California Fruit Preserving Co.	Biggs	California Fruit Canners' Ass'n.
California Fruit Preserving Co.	Oakland	California Fruit Canners' Ass'n.
Cutting Fruit Packing Co.	Colton	California Fruit Canners' Ass'n.
Hunt Bros. Fruit Packing Co.	Santa Rosa	California Fruit Canners' Ass'n.
Chico Canning Co.	Chico	California Fruit Canners' Ass'n.
Lincoln Fruit Packing Co.	Lincoln	California Fruit Canners' Ass'n.
Whittier Cannery	Whittier	California Fruit Canners' Ass'n.
Courtland Packing Co.	Courtland	California Fruit Canners' Ass'n.
Cutting Fruit Packing Co.	Santa Rosa	California Fruit Canners' Ass'n.
Cutting Fruit Packing Co.	San Francisco	California Fruit Canners' Ass'n.
Rose City Canning Co.	Santa Rosa	California Fruit Canners' Ass'n.
Sacramento Packing Co.	Ventura	California Fruit Canners' Ass'n.
Sacramento Packing Co.	Sacramento	California Fruit Canners' Ass'n.
Sacramento Packing Co.	Visalia	California Fruit Canners' Ass'n.
San José Fruit Packing Co.	San José	California Fruit Canners' Ass'n.
Southern California Packing Co.	Los Angeles	California Fruit Canners' Ass'n.
Tenny, A. F., Co.	Fresno	California Fruit Canners' Ass'n.
Visalia Preserving Co.	Visalia	California Fruit Canners' Ass'n.
California Fruit Canners' Ass'n	Stockton	California Fruit Canners' Ass'n.
Cutting Fruit Packing Co.	Santa Ana	California Fruit Canners' Ass'n.
Marysville Packing Co.	Marysville	California Fruit Canners' Ass'n.
Oakland Preserving Co.	Oakland	California Fruit Canners' Ass'n.
Oakland Preserving Co.	Milpitas	California Fruit Canners' Ass'n.
King-Morse Canning Co.	San Francisco	California Fruit Canners' Ass'n.
King-Morse Canning Co.	San Leandro	California Fruit Canners' Ass'n.
Healdsburg Canning Co.	Healdsburg	California Fruit Canners' Ass'n.
Hanford Canning Co.	Hanford	California Fruit Canners' Ass'n.
Fontana & Co.	San Francisco	California Fruit Canners' Ass'n.
Sutter Canning and Packing Co.	Yuba City	California Fruit Canners' Ass'n.
Carquinez Packing Co.	Benicia	G. W. Hume & Co.
Flickinger, J. H., & Co.	San José	
Foster Bros. Home Packing Co.	Tremont	E. Foster.
Golden Gate Packing Co.	San José	Golden Gate Packing Co.
Goetjen, N.	San Francisco	N. Goetjen.
Hunt Bros. Co.	Haywards	
Hickmott Asparagus Canning Co.	Bouldin Island	Hickmott Asparagus Canning Co.
Los Gatos Canneries	Los Gatos	Hooke-Field Co.
Orange Preserving Co.	Anaheim	
Pasadena Packing Co.	Pasadena	
Pacific Fruit Packing Co.	San Francisco	
Redlands Preserving Co.	Redlands	Redlands Preserving Co.
Stetson, F. F., & Co.	Los Angeles	F. F. Stetson & Co.
Taylor, J. E., & Co.	Santa Ana	J. E. Taylor & Co.
Waters, G. H., & Co.	Pomona	G. H. Waters & Co.
Walden & Co.	Geyserville	
F. B. Hood Canning Co.	Emeryville	The Field Mercantile Co.
Central California Canning Co.	Sacramento	The Field Mercantile Co.
Pyle & Son	San José	C. W. Pike & Co.
East Side Canning Co.	Los Angeles	J. K. Armsby Co.
Pomona Canning Co.	Pomona	J. K. Armsby Co.
Corville Packing Co.	San Francisco	J. K. Armsby Co.
Sebastopol Packing Co.	Sebastopol	The Field Mercantile Co.
Overland Packing Co.	San Francisco	C. W. Pike & Co.
A. Mendenhall Cannery Co.	Clear Lake	Mansfield-Lovell Co.
Auburn Cannery	Auburn	
Chamberlain Canning Co.	Kern City	
Code Portwood Canning Co.	San Francisco	
California Canned Goods Co.	Napa	California Canned Goods Co.
Cerritos Valley Canning Co.	Hynes	Cerritos Valley Canning Co.
Griffin & Skelley Co.	Fresno	Griffin & Skelley Co.
Grand Island Asparagus Packing Co.	Grand Island	N. Goetjen.
Los Nietos Cannery	Los Nietos	Los Nietos Cannery.
Moneta Canning Co.	Moneta	Moneta Canning Co.
San José Fruit Preserving Co.	Mountain View	San José Fruit Preserving Co.
American Fruit Packing Co.	San Francisco	C. W. Pike & Co.

FRUIT AND VEGETABLE CANNERIES IN CALIFORNIA—Continued.

Cannery.	Location.	Agent or Drier.
Costa, L. D.	San José	L. D. Costa.
Southland Fruit Canning Co.	Long Beach	
Maywood Canning Co.	Corning	
California Fruit Co.	Ontario	
Napa Valley Packing Co.	Napa	
Jersey Island Canning Co.	Jersey Island	
George D. Kellog Packing Co.	Newcastle	
Rose Canning Co.	Petaluma	
Gibbs-Wilson Canning Co.	San Francisco	

REPORTS

ON THE

Pear-Blight in California.
Olive-Knot in California.
Root-Knot of Plum, Prune, and Peach Trees.
Asparagus Rust.

THE PEAR-BLIGHT IN CALIFORNIA.

By JOHN ISAAC, Special Agent.

To the Honorable the State Board of Horticulture:

Gentlemen: Acting under your instructions to investigate the pear-blight in California, its spread and destructiveness, with a view to taking some measures to prevent its ravages, and, if possible, to reducing its area of damage, I have visited most of the pear-growing sections of the State, personally inspected very many of the principal orchards, besides having carried on an extensive correspondence with all sections where the disease was likely to be found, and herewith beg to submit my report.

Area of Infestation.—Kings County appears to be the center of the disease, and there hardly a pear tree has escaped infection; in many cases whole orchards have been destroyed and in others fully 50 per cent of the trees were killed and the remainder affected to a greater or less extent. In company with Horticultural Commissioner James A. Hill, I visited a large number of pear orchards there, and the disease is so generally distributed that I should estimate that at least 90 per cent of the trees are affected more or less.

In Tulare County, while the disease is very general and has done very extensive damage, the extent of its destructiveness has not been so great as in Kings County. The greater part of the pear orchards are involved, but in most cases the disease was confined to the new growth and the smaller branches. Some trees had been killed to the ground, but the percentage of these was not so great as in the adjoining county.

Kern County is afflicted to about the same extent as Tulare County, and radiating from these counties in all directions the disease seems to decrease in virulence, until in the more northern counties it is unknown.

In Fresno County the pear orchards are very seriously affected, most of the new growth being killed, and the orchards appear as though they had been swept by fire.

In all of the Southern California counties pear-blight is well established, but in none of them is the pear very extensively cultivated, and in consequence the damage done by blight is not serious.

North of Fresno the disease has not obtained any serious foothold.

A few cases have been reported, but, outside of the districts mentioned, it is not general nor is any great danger apprehended from it.

San Diego County: Pear-blight was first reported here in 1899. Few trees have been attacked, but these have suffered severely. All varieties of pears except Winter Nelis were attacked, as were also many varieties of apples. Apples especially affected were King of Tompkins County, Bellefleur, Red June, and Newtown Pippin. The White Winter Pearmain, Smith's Cider, and Rhode Island Greening were found most resistant. The only remedies found at all effective were cutting back and destroying the infected wood. There has been little seen of the disease during the past two years and it appears to be dying out.

Riverside County: Pear-blight first came into notice here about 1896. Its origin is unknown. It has spread more rapidly during the past two years than ever before, until at present there are about 60 per cent of the pear and apple trees involved. The Bartlett is the most susceptible, and the Seckel and Winter Nelis most resistant to its attacks. Cutting out the affected part is the only remedy, and this is successful in about 30 per cent of the cases.

San Bernardino County: Pear-blight is very general here, from 50 to 60 per cent of the trees being affected. It has been known since 1895 or earlier, but has not become serious until within the last three years. There are very few pears grown in this county, so the blight is not regarded as a serious fruit disease. Loquats have been attacked by it and many trees have died. It does not appear to be spreading to any extent.

Los Angeles County: Pear-blight has existed here for several years, but has only recently been regarded as alarming. It has now become general, involving at least 60 per cent of the pear trees and many apple and loquat trees. It is no more virulent this year than last, and it is believed to have reached its limit of destructiveness. The only remedy is cutting out and destroying the diseased trees.

Orange County: Pear-blight is very general here, involving alike pear, apple, and loquat. It was first reported as serious about 1899, since which time it has spread rapidly, until now about 60 per cent of the pear trees are infected and a very large number of apples and loquats are suffering. The Bartlett is the principal pear afflicted, and of these very few escape. Many remedies have been applied, but the knife and saw are the only ones to be recommended.

Ventura County: Pear-blight is found here, but it is not very serious. Pears are not very extensively grown and little attention has been paid to the disease.

Santa Barbara County: Professor T. N. Snow, secretary of the Horticultural Commission, reports: "Up to the present date, no case has been reported to this Board, nor have we observed it in our inspections so far. We shall take special pains in future to see if it is to be found in our county."

Madera County: Pear-blight is found in this county to a small extent, but is not very bad, not over one per cent of the trees being affected. It has been known for several years, but it is not spreading very fast, if at all. No efforts have been made to stay its progress, nor has it been regarded as serious.

Merced County: Very few trees have been noticed as affected with the blight, which has not done any damage in this section.

In Stanislaus County, and counties north from there, pear-blight is not reported, and if it is found, exists in isolated cases and is not spreading or regarded as a threatening danger.

Symptoms of the Disease.—There is probably no disease attacking fruit trees which is so marked or deadly in its effects as the one under consideration. A tree is in full vigor, puts forth a full crop of blossoms, the young leaves shoot out, and the wood appears bright and healthy, and there is every promise of a bounteous crop. In a few days the blossoms droop, wither, and dry up, the leaves turn brown and crisp, the young wood deadens, and in many cases the disease follows down until branches and trunk are attacked and the whole tree is involved and dies to the ground. While the disease is the worst on the pear, attacking the finer pears, the Bartlett being of all varieties the one most susceptible, all the pomaceous fruits are subject to the disease, and it is found on the apple, hawthorn, medlar, quince, and loquat.

The evidences of pear-blight are unmistakable; the scorching of the blossoms, the blackening of the leaves, the gradual dying back of the younger twigs, the progress of the disease from the top downward, an inch or more each day, and finally the death of the larger limbs, are all symptoms that even the most inexperienced can observe. Usually it is the most thrifty trees that are most susceptible to attack and injury. Trees that are carefully cultivated, grown on rich soil, and making a vigorous growth, furnish ideal conditions for the progress of the disease, while those neglected or grown in uncongenial conditions best resist its attacks.

Manner of Attack.—The point of entry of the disease in probably 99 per cent of the cases is through the blossoms. In some cases the new and tender growth may offer a point of entrance, and in rarer cases it may communicate to the older wood, but the blossom is the one general point of entry. The germs of the disease are carried to this point, follow the blossom stems to the fruit spur, thence into the twigs and continue down until the larger limbs become infected. A case prominently illustrative of this came to the writer's attention in Fresno, where some trees in an old orchard had been removed and replaced with young trees, so there were alternate rows of old trees in full bloom and two-year-old trees, one year in the orchard, which had not yet blossomed. Every one of the old trees was blighted, while the young ones, growing in the midst of the diseased trees, were entirely untouched by the blight and were making a thrifty, healthy growth.

In the more susceptible varieties, and under conditions favorable to vigorous growth, the blight often involves the whole tree, but frequently it progresses to a place where it finds a denser wood or other conditions unfavorable to its further progress and stops short, leaving a well-defined line of demarkation between the healthy and diseased portions. The disease, too, makes its most rapid headway while the tree is making its most vigorous growth, becoming less and less virulent as the summer advances and the young growth begins to harden. In some cases, where conditions are especially favorable for wood growth, the disease will work down the twigs and branches at the rate of a foot a day, but usually its progress is at the rate of one to three inches. For various reasons the spread of the disease is sometimes checked, and occasionally the blossoms alone are affected, or the young fruit may turn black and dry up and the course of the disease stop at that, or it may involve the young twigs and not communicate to the older wood, but too often its course is unstayed until the tree attacked is ruined.

History of the Disease.—Pear-blight is not a new thing in either the United States or California. It has been known in the country for over a century, and in this State cases have been noticed for the past twenty-five years, but it has only been within the last five years that it has appeared in such destructive force in the upper San Joaquin Valley as to cause alarm for the future of the pear crop. The cause of the disease was not known before 1880, and prior to that time it was attributed to various causes (none of them correct), to conditions of the atmosphere, climatic changes, etc. Prof. T. J. Burrill, of the University of Illinois, made a special study of this disease, and in 1879 discovered that it was caused by a very minute microbe of the class Bacteria, which is known to science as *Bacillus amylovorus*, and the following proofs are given to show that the disease is caused by it: The microbes are found in immense numbers in freshly blighted twigs; they can be taken from an infected tree and cultivated in pure culture, and in this way can be kept for months at a time; by inoculating a healthy tree with these cultures

Pear-blight bacteria.

the disease is produced; in a tree so inoculated the microbes are again found in abundance.

Recently M. B. Waite, of the Division of Vegetable Physiology and Pathology of the U. S. Department of Agriculture, has made a special study of pear-blight, and added much to our knowledge of the nature, spread, and control of the disease.

According to Mr. Waite: "One of the most remarkable things about this disease is the rapidity with which it spreads through an orchard at blooming time. This peculiarity has thrown much light on the way the microbes travel about, which they do quite readily, notwithstanding the fact that they are surrounded and held together and to the tree by sticky and gummy substances. They are able to live and multiply in the nectar of the blossom, from whence they are carried away by bees and other insects, which visit the blossoms in great numbers for the honey and pollen. If a few early blossoms are infected, the insects will scatter the disease from flower to flower and from tree to tree until it becomes an epidemic in the orchard. We shall see later how the first blossoms are infected. From the blossoms the disease may extend downward into the branches or run in from lateral fruit spurs so as to do a large amount of damage by girdling the limbs. Another way in which the blight gains entrance is through the tips of growing shoots. In the nursery, when trees are not flowering, this is the usual mode of infection. This is often called twig-blight, a good term to distinguish it from blossom-blight, provided that it is understood that they are simply different modes of attack of the same disease."

Bees as Carriers of the Disease.—In Kings County during the past two years there has been a great deal of controversy between the pear-growers and the beekeepers in regard to the spread of the pear-blight germs, it being claimed by the orchardists that bees spread the disease in their search for honey, visiting infested blossoms, carrying the germs to healthy trees, and in this manner spreading the disease over entire areas within the radius of their flight. There is now little question that the contention of the fruit men is largely true. The pear-blight bacillus is inclosed in a viscid, sweetish exudation, and is not spread by the wind, as is the case with fungous spores. It depends upon other means of transportation and distribution, and these means are supplied by insects to a great extent, and when bees are active they become the principal carriers of the plague. At the same time it is questionable whether the exclusion of the bees will have any noticeable effect in preventing the spread of the disease, as there are a host of other insects actively engaged in the work of carrying the germs of pear-blight from tree to tree, and it is impossible to exclude all from the orchards. In an experiment made in Kings County to test the agency of insects in spreading the pear-blight, Horticultural Commissioner Motheral reports on an attempt to exclude them from selected trees by covering the trees with mosquito netting. He says: "We found the task more difficult than we supposed. The mosquito netting was blown about by the wind and torn often, so that we found it impossible to keep out entirely the bees or other insects; but I succeeded in a measure, and as a consequence I have but little blight under the netting; while on the trees all around and all over the orchard almost all the flowers were blighted. I have, also, a fair crop on the protected trees."

The responsibility of bees for the spread of this disease was very fully dwelt upon by Professor Waite in an address at the National Beekeepers' Convention at the Pan-American Exposition. He says:

"We may say that bees are very active agents in the distribution of pear-blight. In order to understand fully, however, the exact part that bees do play in the distribution of pear-blight, it will be necessary to go very briefly over some other points concerning this disease, and to give, in fact, the life history of the pear-blight bacillus through the year.

"In the first place we have three methods by which the pear-blight germ enters the tree: first, through the blossoms, resulting in what is commonly called blossom-blight, to distinguish it from the other methods of communication of the disease; second, through the tender tips of growing twigs—but either blossom-blight or twig-blight may run down on the limbs and trunks; and, third, blight may enter directly into the fleshy bark of young trees.

"The latter is comparatively a rare method—in fact, by far the greater number of infections are directly through the blossoms.

"Now, of course, it is only in blossom-blight that the honey bee is concerned, and, furthermore, all insects which visit the pear, apple, and quince blossoms are more or less concerned in the matter of distribution on the blossoms. I may say, also, that other insects than the honey bee are largely instrumental in the distribution of pear-blight on the twigs, and we have scarcely been able to find a direct, normal method of introduction of the disease in the twigs without the introduction of some mechanical or insect puncture. Beginning with the spring of the year, the disease breaks out on the blossoms. Ordinarily, trees do not have the blight very badly until they come into bloom, and this, as I said before, is mostly due to its distribution by bees and other insects which visit the flowers and are the main factors. The pear blossom is a very open one and is extensively visited by a whole list of insects. I started out to get a list of the insects which visit pear blossoms, but when I reached the number of forty I gave it up. Nearly all the flying insects—the bee being most active of all, but even beetles and wasps, and occasionally a humming-bird, the latter, of course, not being an insect—visited the pear blossoms and carried the disease along.

"The blight begins on the blossoms in early spring; then during the summer we may have twig-blight clear into September. The disease runs down on the twigs and in the great majority of cases dies out. The disease works in the bark and as a rule finds the tree, at some time during the late spring and summer, a little too dry and tough for it to take hold of, and it dies out. Occasionally infections, however, keep running down on the twigs, get into the fleshy bark and keep on working slowly till fall. After this season of the year the trees are so moist that those germs will not dry out, but will live over winter, resulting in what I call 'hold-over blight.' It stands zero weather perfectly. In the spring the hold-over cases start off when root pressure begins and when the tree is forced full of sap. In some instances in the South very active changes go on in these hold-over cases during mild winter weather, but in the Northern States they don't have time to do much damage. The virus runs out on the sides of the tree and drops down. I saw some very fine cases in the mountains of Virginia last spring. The flies and wasps and other insects swarm on the exuding sap, and fly from that to the opening blossoms and start the infection for the next year.

"Bloom-blight, then blight running on the branches, then hold-over blight, then reinfection next spring on the blossoms. When it is started on the blossoms it is carried like fire. Now, as I started to say a moment ago, you would like to have the authentic proof that the bees carry pear-blight. I have worked long and patiently on this problem for three or four years. In the first place, the great abundance of blossom-blight leads to a suspicion, at least, that we have here some normal, effective method of distribution. There is some regular way about it, and we shall see what that method is. In the second place, the disease begins in the nectaries. The germs of the pear-blight are found growing and multiplying in this nectar. I determined this mostly by artificial infection. By taking pure cultures of the pear-blight germ and touching the nectary with a camel's-hair brush I started the pear-blight off. It requires no puncture. It is the only point on the tree where the germs enter normally without a puncture. The nectar has no shield or cuticle over it to keep out the germs.

"Now my first acquaintance with this relationship of bees to pear-blight came about something like this: When I had succeeded in isolating the pear-blight germ I immediately tested the validity of my cultures by a series of experiments with a camel's-hair brush on some blossoms, and I inoculated and labeled a number of blossoms around the lower part of a pear tree on the Agricultural Department grounds at Washington. I spent a good deal of time actually watching those blossoms growing, and, of course, here came the bees right in front of me, and as the germs began to grow in the nectaries they began to visit my infected blossoms, and I saw them fly from these over the trees to the other blossoms. I captured two bees; caught them in the act of visiting the infected blossoms, and, taking them into the laboratory, made plate cultures by the method in which we ordinarily isolate bacteria, and succeeded beautifully in isolating pear-blight germs from the mouth parts of the bees.

"In other words, we actually caught the bees in the act, and this was repeated a number of times and in different parts of the country. Now it seems as though we had matters pretty well proven. My trees that I had infected came down beautifully with pear-blight. The clusters all came down which I had infected and labeled, and a large number of others all around the tree.

"The question, then, was as to what other methods of distribution the pear-blight germ might have, and with quite an elaborate series of experiments I set about to find out the truth of the matter. The main question was whether the pear-blight germ was carried by the wind. If it could be blown by the wind it would not make any difference whether the bees carried it or not; but it was not blown by the wind, and became a matter of considerable importance. So, having gone through one spring in Washington, I moved up to western New York and passed through another spring.

"A gentleman near Brockport, N. Y., very kindly turned over a small orchard to me, in which I could start a small artificial epidemic of pear-blight. We inoculated about six or eight trees and about eight or ten small branches on each tree. Before inoculating them I covered a large portion of the tree with bags of various density—mosquito netting, cheese cloth, and paper—reasoning that by covering the trees with mosquito netting if the disease is blown by the wind it would certainly blow through the mosquito netting and appear under the bags.

"The disease gradually spread from my centers of infection, but in no case did the disease get through the mosquito netting, although a large percentage of the clusters broke down on the trees that were infected outside of the mosquito netting. We inoculated blight in the bags, and kept it in; we inoculated it outside, and kept it out.

"Now, in further support of the view that I have taken that pear-blight is not borne by the wind, we have two important facts. The first is that pear-blight virus is always a sticky mass, which can not be blown by the wind. It is a gummy material that can readily be carried by anything that touches it, but not by the wind. The second fact is that the pear-blight germs on drying rapidly die. In ordinary orchard conditions a few days after the twig dries out the germs die, so that pear-blight germs are not lying around promiscuously. We have no evidence whatever that we can get infection in any other way, so I think you will be willing to accept my proposition that bees are active agents in carrying pear-blight on blossoms, and that the blight is not carried by the wind.

"Now, we have been giving the honey bee such a bad record that it is with great pleasure that I turn to another phase of this subject. Very early in this work the question came up in my mind, if the honey bee was doing unfortunate work, what was its function on the blossoms? The question came up, are our pear blossoms of such a nature that they required this insect fertilization by the bees? So I started out to determine the relationship between the bees and the fertilization of the blossom. The result was a series of experiments lasting over three years.

"On account of the limited time, I shall have to state very briefly the results of this pollination work. In the first place it came out that most of our pears, as a result of careful hand pollination on test, are sterile to their own pollen. Cross-pollination is characteristic of our orchard fruits. It is perhaps not true of peaches and quinces, but as far as apples and pears are concerned, cross-pollination is a necessity.

"By trying a large number of experiments I concluded that insects were the largest agents in cross-pollination. The blossom of the pear is not of the type of wind-fertilization blossoms, but is distinctly of the insect-fertilized type. Now, this matter is so complicated that it will be impossible, in the short time at my disposal, to go into the details of fertilization. To make the story short, we may say that from the biological standpoint the bees are doing their normal, natural work in visiting the pear and apple blossoms. The blossoms are for the bees to pollinate, are developed by insects, and the insects have been developed in correlation to them. It is a normal biological process: the visiting of orchard fruit blossoms by bees. The bees are there performing their proper function.

"Now, the question is, Is the honey bee to be looked upon as useful or injurious? Do its beneficial effects equal its injurious effects? When there is no pear-blight about it is easily decided in favor of the usefulness of the bee; but when there is an outbreak of blight it is a rather hard question to decide.

"There are no doubt times, when pear-blight is rampant in an orchard, when it would be better not to have the honey bee or any other insect in there until the blight is past. On the other hand, from the standpoint of the beekeeper, it can be said that in most cases wild bees and other insects would do a large part of the work, both good and bad, without the honey bee; so that we could not get rid of the infection of the blight even if we do dispense with the presence of the bee.

"I feel satisfied that in the eastern United States the honey bee must be looked upon as a useful element in the orchard. I have an apiary in my own orchard. The people in California have had some terrific outbreaks of pear-blight, and are very much concerned over the matter, and they have reached the conclusion that they can dispense with the honey bee as an orchard pollenizer; that their Bartlett pears will set all the fruit that is necessary, without insect fertilization. I have never investigated the subject in California. My only knowledge of the case is due to my observation of California fruits. There are so many seedless Bartlett pears from California that it looks as if they were necessarily self-pollenized, and there may possibly be some truth in their views that their pears will set without cross-pollenization. In that case it moves the thing a little against the bee, and if pear-blight is rampant in an orchard it would certainly be desirable—at times at least—not to have bees about."

REMEDIES.

Pear-blight being of bacterial origin and spreading with the sap through the cambium layer, thoroughly protected from all outside influences, it is very evident that no external treatment can reach it, and that all forms of sprays, washes, or fumigation are valueless. There are but two methods of reaching the disease—prevention and extirpation. In those sections which the disease has not reached, every precaution against its introduction should be taken. In orchards where it has obtained a lodgment, only the most vigorous application of the saw and knife is of any avail, and even the most heroic treatment is not always successful.

It has been shown that the disease makes the slowest progress in the least thrifty trees, and that whatever means are taken to force the growth of the tree furnishes food for the disease, while whatever will tend to stop growth will also have a tendency to stop the progress of the blight. The greatest progress of the disease is made during the season of most vigorous growth, and it decreases later in the season as the wood hardens, and finally the active germs of the disease die out when the tree has completed its seasonal growth. Upon this hypothesis the following rules are laid down for dealing with the blight:

Pruning.—Pruning in the winter time, or when the tree is dormant, tends to make it grow and form a great deal of new wood, and on that account it favors pear-blight. Withholding the pruning-knife, therefore, may not otherwise be best for the tree, but it will reduce to some extent its tendency to blight.

Fertilizing.—The better a tree is fed the worse it will fare when attacked by blight. Trees highly manured with barnyard manures and other nitrogenous fertilizers are especially liable to the disease. Overstimulation with fertilizers is to be avoided, especially if the soil is already well supplied.

Cultivation.—The same remarks apply here as in the case of fertilizing. A well-cultivated tree is more inclined to blight than one growing on untilled land, although the latter often do blight badly. Generally, good tillage every year is necessary for the full development of the pear and quince trees, and is more or less so for the apple in many parts of the country, but the thrift that makes a tree bear good fruit also makes it susceptible to blight. Check the tree by withholding tillage, so that it makes a short growth and bears small fruit, and it will be in a better condition to withstand blight than it would were it cultivated. In cases where thrifty orchards are attacked by blight and are threatened with destruction, it may often be desirable to plow them once in spring and harrow soon after the plowing, to plow them only, or to entirely withhold cultivation for a year, mowing the weeds and grass or pasturing with sheep. A good way is to plow the middle of the space between the rows, leaving half the ground untouched.

Irrigation.—In irrigated orchards the grower has the advantage of having control of the water-supply. When such orchards are attacked, the proper thing to do is to withhold the water-supply or reduce it to the minimum. Only enough should be supplied to keep the leaves green and the wood from shriveling.

Extermination of the Blight Microbe.—We now come to the only really satisfactory method of controlling pear-blight—that is, exterminating the microbe which causes it, by cutting out and burning every particle of blight when the trees are dormant. Not a single case of active blight in the orchard, or within a half mile or so of it, should be allowed to survive the winter. Every tree of the pome family, including the apple, pear, quince, Siberian crabapple, wild crabapple, the mountain ash, service berry, and all the species of Cratægus, or hawthorns, should be examined for this purpose, the blight being the same in all. The orchardist should not stop short of absolute destruction of every case, for a few overlooked may go a long way toward undoing all his work. Cutting out the blight may be done at any time in the winter or spring up to the period when growth begins. The best time, however, is undoubtedly in the fall, when the foliage is still on the trees and when the contrast between that on the blighted and that on the healthy limbs is so great that it is an easy matter to find all the blight. It is important to cut out blight whenever it is found, even in the growing season. At that time of the year, however, it can not be hoped to make much headway against the disease, as new cases constantly occur which are not sufficiently developed to be seen when the cutting is done. In orchards where there are only a few trees, and the owner has sufficient time to go over them daily, he will be able to save some which would otherwise be lost. However, when the trees stop forming new wood, the campaign should begin in earnest.

"The best way to fight this disease is to prevent the blight from over-wintering by carefully going over the trees in the fall and again in the winter and early spring and removing every case of hold-over blight. The germs which are to start the infection the coming year are all in the tree within easy reach of the operator. It is only a question of skill and thoroughness on his part as to whether they are allowed to survive or not. It is usually best to go over the trees in summer as well, and make a fight against the blight during the growing season. This, however, is not as easy to do successfully as to cut it out in the fall, for the reason that new infections are continually taking place during the growing season and new cases of blight may already be in the tree but not sufficiently developed to attract the attention of the operator. In cutting out the blight great care must always be taken to cut on healthy wood well below the lowest point discolored by the disease. It is usually safer to cut at least a foot or more on apparently sound wood, although by carefully studying the case it may not be necessary to go so far below. An important matter in cutting out the blight is to carry along some disinfecting solution with which to sterilize the knife or other tools used. For this purpose, Professor Waite recommends any of the following solutions to be used: Mercuric chloride, or corrosive sublimate, 1 part to 1,000 parts of water; 5 per cent carbolic acid solution; or a solution of chloride of lime. The first may be prepared by purchasing tablets of a definite amount at a drug store. These tablets can be kept in a small bottle, and a pint or quart bottle filled with water and one of the tablets added. Upon concluding work the bottle should be emptied, to avoid the danger of poisoning children or unsuspecting persons. By this means the danger of using this deadly poison may be avoided. Carbolic-acid solution may be prepared by simply adding a tablespoonful or more to a bottle of water and shaking it up. The saturated solution, which contains about 5 per cent of carbolic acid, is the proper strength to use. A solution of chloride of lime will answer about the same purpose, and is made by adding about twenty parts of water to one part of the commercial chloride of lime, shaking it up and pouring off the clear liquid. This is only fit for using while fresh. Any of these solutions can be carried by the operator, and a strip of cloth a yard or so in length should be fastened to the clothing, leaving one end hanging free. When cutting into active blight, the ends of the cloth may be kept saturated with the disinfectant and the knife sterilized by wiping before using it on the sound wood. It is also better to wipe off the wound on the sound wood with the saturated cloth, otherwise there will be the danger of leaving the blight germs on the cut surface and merely starting the blight over again. A knife used to cut into blighting tissue becomes subsequently a veritable inoculating instrument, and should always be sterilized before use on healthy tissues."

CONCLUSIONS.

Pear-blight is limited in its destructive work to the counties of the southern portions of the State, and does not exist to a dangerous extent north of Fresno.

The disease is the most insidious and destructive that has appeared in our orchards.

Its principal point of entry is through the blossoms and its progress is downward, varying in speed from an inch to several inches daily.

The healthiest trees, those making the most vigorous growth, are the most susceptible to attack.

The pear is not the only tree attacked by blight, but the disease is common to the whole pomaceous family.

The disease is of bacterial origin, due to the presence of a microbe known as *Bacillus amylovorus.*

It is spread by bees and other insects, which carry the germs from diseased to healthy trees.

The bacillus dies out when the growth stops and the wood hardens.

The most effective preventive methods are neglect of the tree, and the stoppage of its growth.

Sprays and washes are utterly ineffective and useless as remedies.

Vigorous cutting out of all diseased wood, well below the point of infection, is the only remedy that can be recommended.

All tools and implements used for pruning diseased trees should be carefully disinfected before they are again used, or they may become instruments in spreading the disease.

THE OLIVE-KNOT IN CALIFORNIA.

The attention of this Board having been called to what appeared to be a threatening disease of the olive—tuberculosis of the olive, or olive-knot—an agent of the Board was instructed to visit the different olive sections to ascertain the extent and spread of the disease, with a view to checking its further progress.

The olive-knot is one of the most serious diseases that can attack the olive tree, involving, as it does, the entire structure, being confined to no special portion, but breaking out on all parts from roots to leaves. There is but one sure and safe plan, and that is the total destruction of the infected tree. Fortunately, the disease has not as yet obtained a serious foothold in this State, and radical measures have already been taken to stamp it out.

The disease, although known in Europe for many years past, was first reported in this State from Merced County, where it had broken out in an orchard belonging to A. R. Gurr, who noticed its appearance on one of his trees in 1893, from which it spread to adjoining ones and finally attacked a large number of trees in his orchard. These trees have all been rooted out and destroyed with the exception of three, which, standing in an isolated spot, remote from any other olive trees, the owner has left in order to study the progress of the disease. The remaining trees are a Nevadillo, a Picholine, and a Mission, and all are affected with the knot, the Nevadillo showing it in its worst form and the Mission being the least injured. In this section the disease is practically under control, and while the existence of the infected trees implies more or less possibilities of its transmission to other sections, still, being isolated as they are, the danger is reduced to a minimum.

Another and more serious outbreak was reported to the Board early in 1901 from the Maywood Colony, in Tehama County, and Alexander Craw, Quarantine Officer of the Board, was delegated to make an investigation and advise with the owners of the olive orchards there as to a course of action. In his annual report to the Board, Mr. Craw says:

"According to your instructions, I visited Tehama County on June 3d and 4th, and investigated the reported existence of the 'olive-knot' (*Bacillus oleæ*) in several young orchards. With Mr. Harvey C. Stiles, I visited a number of young olive orchards, and although we found

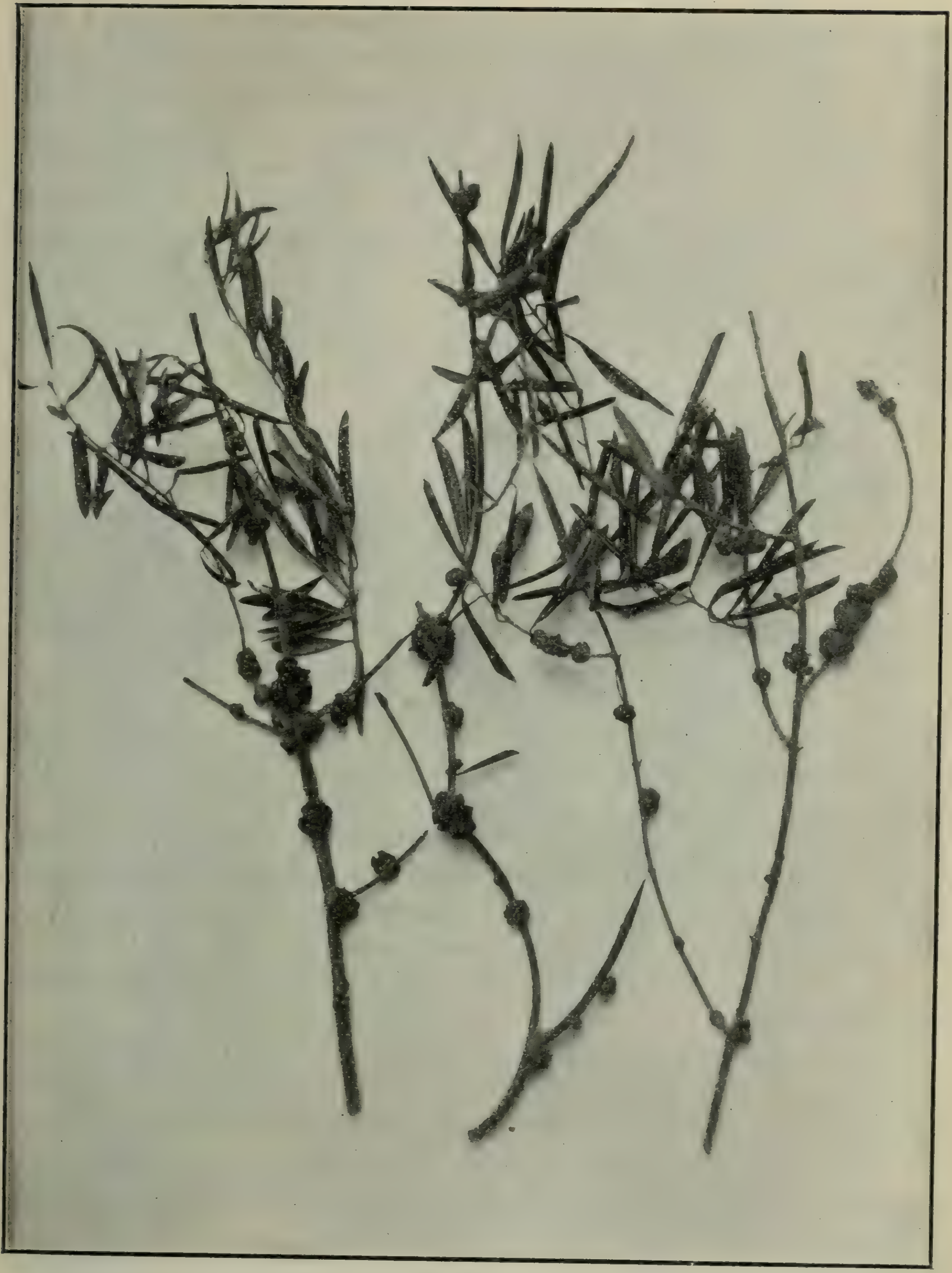


PLATE I. OLIVE-KNOT (*Bacillus oleæ*) AFFECTING TWIGS AND LEAVES.

indications of the disease, there was no appearance of any virulent cases. This may be owing to the fact that the trees had been planted within the year. It was the desire of a number of the orchardists to have the disease stamped out of the county if possible, and as they anticipated some opposition on the part of non-resident owners, I submitted the matter to the Attorney-General to ascertain if the County Horticultural Commissioners or the State Board of Horticulture could take any action toward stamping this disease out of that and other counties where it has appeared. The opinion of the Attorney-General is given on pages 53 to 57 inclusive, of your bulletin, 'Horticultural Statutes of California.' It would appear that the County Horticultural Commissioners have power to abate such nuisances in their respective counties. There is nothing, however, in our statutes conferring such power upon the State Board of Horticulture. It is to be hoped that the County Horticultural Commissioners will see that the destructive olive disease is stamped out of the State."

In October of the present year a special agent of the Board visited the infected section, and, in company with Mr. Woodson and Horticultural Commissioner A. W. Samson, made a thorough investigation of the whole district, visiting the various olive orchards and inspecting a large number of trees, but no case of olive-knot could be found. The Horticultural Commission, aided by the owners and the Colony association, had taken the matter vigorously in hand and entirely extirpated the disease. A thorough inspection of each orchard had been made, and every tree which gave any evidence of disease had been removed and burned, and the ground where it stood had been disinfected and left exposed to the air, no other tree being planted near it. The only varieties infected were Nevadillo and Manzanillo. These were all purchased from one nursery, and it is supposed that the trees had the germs of the disease when planted, which was in 1899. The disease appeared soon after this, and in 1901 all the infected trees were removed. As there has been no indication of the disease since that time, it is believed to have been eradicated.

The work done is to be commended, as there are over 300,000 olive trees in this colony, and the olive industry is a very promising one. There were among these, 781 trees that indicated the olive-knot beyond question, and the early destruction of these, with subsequent precautionary measures against further outbreaks, has unquestionably saved the orchards in this district from a terrible scourge.

Later, under the guidance of Mr. Harvey Stiles, of Chico, orchards in Butte County were visited and found seriously affected with the olive-knot. In Mr. Woodward's orchard near Chico, where the disease had been especially bad, a great part of the trees had been removed and destroyed, but all that remained were affected—the Mission less so than

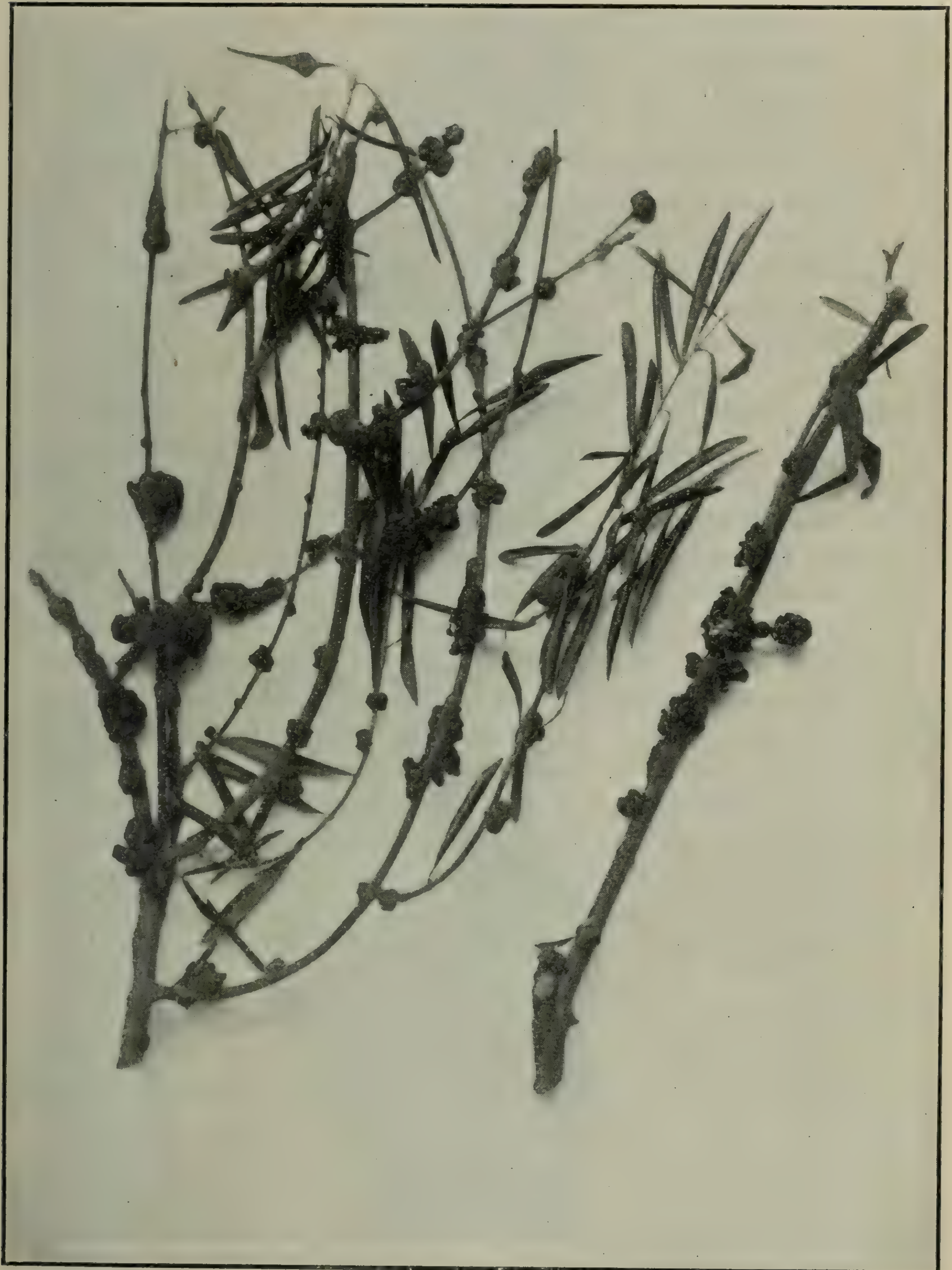


Plate II. An Advanced Case of Olive-Knot (*Bacillus oleæ*) on Twigs.

any of the other varieties, which included Nevadillo, Rubra, Macrocarpa, and Columella. This orchard contained twenty acres, upon which at least one half the trees had been destroyed and removed. Mr. Stiles, who has made an extensive study of this disease in his section, furnishes the following information in relation thereto:

"The 'European' olive-knot, sometimes called 'tuberculosis of the olive,' the result of the attacks of *Bacillus oleæ*, is now prevalent in several sections of California. This disease came to notice in 1893, and by 1898 had spread so rapidly that nearly all the trees in the orchard were affected and some completely ruined. Soon thereafter the orchard was destroyed by the advice of horticultural authorities, and it was supposed that the disease was eradicated from the State. The Agricultural Department of the State University issued that year a bulletin (No. 120) on the subject, followed in 1900 by 'Condition of Olive Culture in California' (Bulletin No. 129), in which the matter was followed and conclusions drawn that the disease was probably not existent. In April, 1891, I discovered it in young orchards, and had soon located it in about fifty orchards in one locality. I immediately had it identified by Professor Bioletti of the State University and Professor Pierce, of the United States Department of Agriculture, and have since found it in several widely distant localities. I early began to search for the source of the infection, and have now succeeded in tracing every case that I found to one importation of foreign trees propagated from and sold throughout the State by one nursery. One other case is reported of an importation of trees that were infested with the knot when they arrived, but evidently the disease was destroyed there, for no cases of infection are reported from them. The disease seems to spread very rapidly and to assume more virulence here than in Europe. It develops also very seriously on the roots rather than on the top principally, as the writings denote. Trees have been entirely destroyed by it in three or four years after planting, but these cases undoubtedly had it when planted.

"The inspections have covered fully 400,000 olive trees in a dozen widely separated localities, and constantly I have found Missions growing among or alongside infected trees of the other varieties, and mostly unaffected. In most cases they were grown in the same nursery as the infected trees, shipped together in the same car (often in the same bales), were cultivated and pruned by the same set of tools, and otherwise exposed in every possible, practical way to orchard or nursery inoculation. Though Professor Bioletti's experiments have shown beyond a question the possibility of forced inoculations (see Report of State Board of Horticulture, 1899), I think this multitude of evidence is pretty conclusive that the Mission is at least strongly, practically resistant, though not actually immune. I know one orchard of Missions

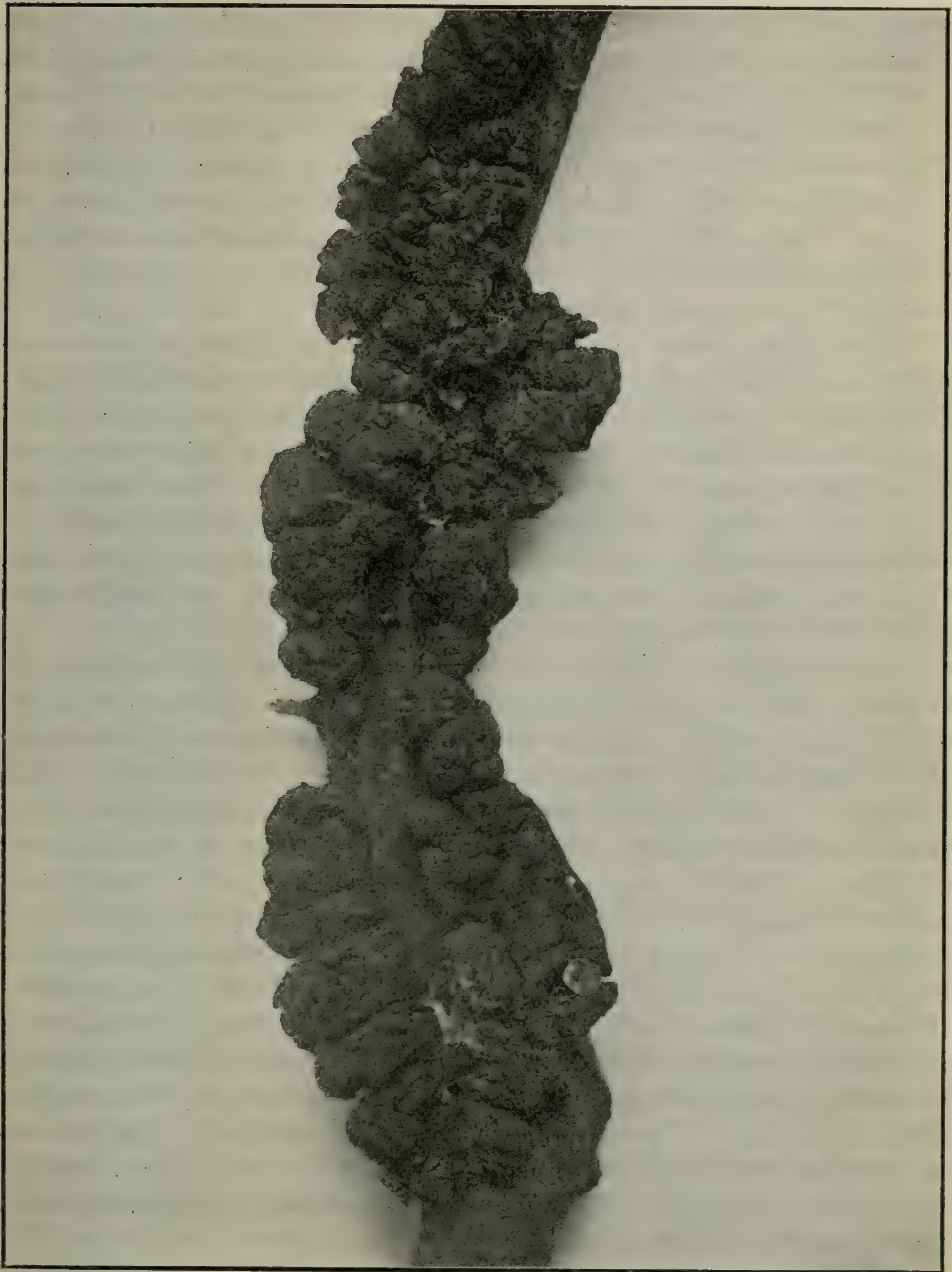


PLATE III. FULLY DEVELOPED CASE OF OLIVE-KNOT (*Bacillus oleæ*) ON BRANCH.

growing—entirely unaffected—alongside several hundred trees of Rubra, every tree of which latter is affected, many of them killed. There are trees with literally tens of thousands of knots, in most active stages of development, standing only a few feet from the Missions, and, as in the other cases, both varieties have had a common nursery origin, and have been shipped, pruned, and cultivated in common, and the Missions thereby exposed to every possible practical infection."

Attention was first directed to this disease in the United States by Professor Newton B. Pierce, of Santa Ana, who published a description of it in the Journal of Mycology in 1891. During his researches in Europe, Professor Pierce found the disease quite common in some sections around the Mediterranean, and drew the attention of California to its danger. In his report he says:

"The tubercle of the olive is an excrescence upon the limb of the tree which pardonably might at first be mistaken for an insect gall. These excrescences or tumors are quite variable in size; probably most of them are mature before reaching an inch in diameter, but some become large, coarse knots. Many branches cease to grow, in whole or in part, beyond the tubercle, after the latter has become partially developed. Some branches become stunted, while others die entirely toward the end. Hence, the growth of the tubercle is largely limited by the life and vigor of the limb bearing it.

"Dr. Savastano says that the tubercles occur upon branches from one to fifteen years of age. In forming, the tubercle commonly takes its origin quite near the cambium zone, though more frequently the center of the bacteria begins to form in the liber portions of the fibro-vascular bundles. To the unaided eye the forming center appears like a very small transparent spot, which, under magnification of one thousand diameters, shows the colony of bacteria already formed. There is now manifest about the colony a hypertrophy of the elements, which may become more or less profoundly altered. As the colony enlarges the hypertrophy increases. The tubercle grows until in time it cracks through the exterior bark. When the tubercle is formed its growth is not usually arrested, but it continues to increase more or less in size each year, often attaining a diameter of 0.01 to 0.02 meter (two fifths to four fifths of an inch). The tubercle is formed in the spring; during the heat of the summer the hypertrophy is arrested, but the colony of bacteria increases considerably. Then, during the autumn renewal of growth, the hypertrophy begins again.

"The irritation or stimulation caused by the presence of the bacillus, so far as our observations have extended, produces only a localized growth of tissue. There is scarcely more evidence of a general or constitutional disorder of the sap of the tree affected than is produced in the oak under the action of the Cynipidæ. The stimulation of the affected branch scarcely extends beyond the node or internode where the swelling occurs. The impoverishing action of this growth, however, is often plainly observed on the entire twig beyond the tubercle. The limb sometimes shows a marked reduction in diameter, though perhaps green and healthy in other respects. In a majority of cases the enlargement only involves one side of the branch. It is not uncommon to find two centers of inoculation producing coalescing tubercles; but the distinction of origin is rarely lost. So far as I am aware, progressive death of the limb below the point of infection, as is the case with pear-blight, never occurs. There is no analogous and general pathogenic degeneration of the tissues, as found in limbs affected by that disease.

"From some of my first observations, where I found the tubercle developing at the node of the limb, I thought it likely that inoculation had been effected by means of the axillary buds. Later, however, many tubercles were noticed, located by internodes, and having no connection with the leaf axil. This has left the method of entrance of the bacillus obscured, unless, perchance, it be through the growing point, and continued growth has left it within the internode or at the node. This explanation seems more probable than that the organism has directly penetrated the bark of the branch. It is also rather indorsed than otherwise by the fact that whenever mechanical injury has occurred to the bark, laying bare the cambium tissue, the tumors are often unusually numerous. They are most common when a bud or leaf or branch has been broken off, or where some injury or splitting of the branch has occurred. In one case observed, where a branch had been split for a few inches, three distinct centers of inoculation were seen at the edge of the ruptured bark within the distance of two inches. Undoubtedly, however, inoculation may occur through slight cracking or other injury of the bark.

"The local and general distribution of tuberculosis of the olive is peculiar and interesting. There is no such sweeping and complete infection accomplished by this disease as is the case in the spread of many germ diseases. I was told that near Genoa the disease is very common and quite destructive. At Rome I visited an olive grove near Colonna, some sixteen miles from the city and north of the Alban hills. In company with Professor Cuboni, I made careful search for this disease, and only obtained a single tumor from a considerable number of trees examined. Another case somewhat similar occurred at Portici. The agricultural school building there was formerly a royal residence, and retains back of it an extensive park, which was fitted up in connection with the residence or palace. Here is an extensive olive grove. Dr. Savastano, his assistant, and myself searched through this grove for some time for tubercles, only finding, at last, a few on the upper limbs of a single tree. At Cancello, some twelve to fifteen miles north of

Vesuvius, is a large olive grove covering the hills at that place. I here spent several hours in a fruitless search for this disease. At Palma, about an equal distance southeast of Cancello, the trees were quite badly infected. Upon a single small branch I counted not less than twenty-nine swellings. All about the hills north of Messina, Sicily, especially in the neighborhood of Faro, the olives are badly infected, and in one or two cases nearly the entire top of the infected tree was ruined. In the province of Syracuse, where olives are largely grown, and where they are very old and thrifty, no signs of this disease were seen. At Palermo, northwest Sicily, it was again encountered, and noted as being the worst phase of the disease seen up to that time. In Algeria I did not encounter the trouble, but have little doubt of its existence there, as well as in all of the Mediterranean olive-growing countries. It exists in France. My observations show me that the disease is very irregular in its distribution. One olive grove may be free from it, or nearly so, while another, not far distant, may be badly infected. One tree in a grove may be, apparently, the only one infected. Again, the disease may be localized upon one portion of a single tree. Probably nothing short of a clear understanding of the means of distribution and infection will explain these facts.

"Careful attention to the excision of all affected branches is apparently all that is required to keep this affection from spreading and doing serious damage.

"As the olive industry is becoming one of importance on the Pacific Coast, it is well that those interested should have the facts relative to the various enemies of that industry placed before them. In this way they may become familiar with those diseases not yet affecting their groves, and may take steps which will prove an ounce of prevention, worth more than a pound of cure."

The disease has been known in Europe for many ages, but not until within the last century did it attract attention on account of its destructive qualities. The improvement of the olive, followed by more careful cultivation, produced trees more susceptible to the disease, and it began to force itself on our attention as a problem to be met and solved. Dr. Luigi Savastano, Professor of Arboriculture, of the Royal High School of Agriculture, at Portici, Italy, has made an especial study of this disease, which he describes as follows:

"The tubercles which characterize this disease are generally formed on branches of from one to fifteen years of age, where the bark is still smooth and not cracked. They are generally isolated, but sometimes take the miliary form. They are rare on the roots, and still more so on the leaves and fruit. So far I have not found them on the flowers, but believe they may occur there.

"The formation of a tubercle takes place in the following manner:

Generally, quite close to the cambium layer, and most frequently in the bast, a colony of bacteria commences to form. To the unaided eye it appears as a small transparent spot. With a magnification of one thousand diameters this is seen to be a colony of bacteria. At the same time a hypertrophy of more or less degenerated elements commences to form around this colony. The colony increases in size and becomes dark-colored. The hypertrophy increases, causing the tubercle to enlarge and finally burst through the cortex, and split. A tubercle, thus formed, continues to grow each year more or less, until it attains a diameter of from one to two centimeters. The tubercles commence to form in the spring; during the heat of summer the hypertrophy is arrested, but the colony of bacteria continues to increase. Later, during the autumn vegetative growth, the hypertrophy recommences. In the fruit there is no true hypertrophy."

A number of experiments were made with a view to determining the methods of spreading the disease and the susceptibility of the different varieties, and Dr. Savastano summarized the results of his experiments as follows: "(1) Wounds do not cause tubercles, except on plants which are already predisposed to the disease; (2) Even in these plants a wound does not always cause the formation of tubercles; (3) Heavy pruning causes the formation of new tubercles, and an increase in size of the old ones on affected trees; (4) The formation of tubercles is in direct ratio to the vigor of the plant."

The formation of the knots on the tree is the result of an effort on the part of nature to repair the damage done by the bacteria. These, forming in colonies, seriously injure the portion of the tree in which they locate, working directly on the sapwood. As this is destroyed, nature endeavors to repair the damage by forming a new growth to heal over the wounds. This new growth supplies the bacteria with fresh material upon which to work, and the disease, instead of being checked, is spread by the very vigor of the tree. It is for this reason that the most vigorous trees suffer most from the attacks of the disease. Trees growing in good soil, under favorable conditions, well cared for, and responding well to their favorable conditions, are those which suffer most from the attacks of *Bacillus oleæ*.

There are several different forms of knots or calluses which are common to the olive tree and which do not indicate the existence of disease, although they are sometimes mistaken for the knot caused by the bacteria. When once seen, however, the genuine olive-knot, which is rough and warty in appearance, can never be mistaken, and our illustrations give the reader a very good idea of its appearance.

Conclusions.—The olive-knot (*Bacillus oleæ*) is at present confined to a comparatively limited area in this State.

The disease is not spreading, but owing to the destruction of diseased trees is being brought under control.

The most efficient remedy would be the destruction of these trees, and of all others in which any symptoms of the disease may hereafter be found.

No varieties are immune from its attacks, although the more delicate varieties are most susceptible.

The Mission olive is more resistant than any other variety, and is in little danger of infestation, unless the disease is carried to it from infected trees in pruning or cultivating with infected implements.

Trees grown under the best conditions and making the most vigorous growth are more subject to attack than those which are neglected.

Whatever stimulates the growth of the tree favors the spread of the disease.

ROOT-KNOT OF PLUM, PRUNE, AND PEACH TREES.

Root-knot has been more than usually prevalent in some localities during the present season, attacking peach, plum, prune, and almond trees and especially those grafted on plum stock, which seem more susceptible to attack than other varieties, although all are liable. There are several forms of this disease and the causes are as various as the disease. One of the most insidious and troublesome forms of the disease is the so-called beaded root-knot, which shows in a mass of small swellings or tubercles strung along the fibrous roots like beads on a string, whence its common name. This form is due to the attacks of a small nematode worm, microscopic in size, which increases with wonderful rapidity and soon involves the whole root-system of the tree attacked. This form is not often met with here, and when discovered on nursery stock or orchard trees, should be at once eradicated by the entire destruction by fire of the plant on which it exists.

A more common form of root-knot manifests itself in large tubercles on the main roots, especially where they branch from the trunk of the tree, and frequently involving the whole trunk near the ground. Root-knots are sometimes due to fungous growths, in which soil conditions and the constitutional predisposition of the tree aid materially, while other forms will sometimes follow a mechanical injury.

In nursery stock all galled trees should be burned at once, as they are not only unfit for planting, but will become the cause of spreading the disease to otherwise healthy trees. It is worse than a waste of time to plant out diseased trees, and any effort to save them is foolishness. Where the common root-knot is found in the orchard, the trees may be saved for some time by removing the soil from the diseased portions and cutting away the knots with a sharp chisel. Trees may live for several years and give profitable crops even after they have developed the disease, but most efforts at a permanent cure have proved futile. Where the knot has girdled the tree it is of no use to endeavor to save it, and it might better be removed and burned. Whenever a tree has been removed for root-knot, no other tree should be planted in its place until all danger from contagion is past. The soil should be exposed to the air and thoroughly mixed with quicklime and left for a year or more.

Several years ago W. Egbert Smith carried on a series of experiments for the treatment of root-knot, and in some cases with apparent success, and we give his method and its results in his own language:

> I found that the root-knot is attached by quite a small foot-stalk, or root-of-the-knot, which extends quite deeply into the stock or root of the tree. This root-of-the-knot, or core as it may be called, can be traced by a discoloration and softening of the wood substance. Owing to this fact it is quite difficult to entirely remove the diseased wood. I found it so, especially when clusters of knots were found—some as large as a man's fist—growing under the base of the main roots, as well as around the principal root stem. This kind of work was not only tedious, but, as I found later, was quite discouraging; because young knots rapidly grew again the next year from the same core. Observing the soft and spongy nature of the knot led me to think that the application of some substance in fluid form might penetrate and kill the diseased wood without injuring the healthy wood. I determined to make some experiments in this line at once.
>
> For these experiments I selected common substances, not with any theory about their particular chemical action, but rather because they would be cheap and easily applied, if successful, and because they were somewhat used by orchardists for other purposes. The chosen list embraced sulphuric acid, carbolic acid, petroleum, coal tar, cupric sulphate, ferric sulphate, sodium chloride, and potassium carbonate. About a dozen of the worst affected trees were selected for treatment, and wooden tags were prepared with the names of each substance to be applied; also, the date of treatment, October 31, 1890, was written on each tag. The acids were each diluted with water one half. The sulphates, chloride, and carbonate were dissolved in water to a saturated solution. The application of these fluids was made by boring into the root-knots with a carpenter's brace and three-eighths bit. I aimed to bore to the core of the knot. Then, from small bottles I poured these holes full of the prepared fluids, attaching the tags to branches at the base of each tree, as the work proceeded. The soil was then thrown back to the tree, and no further special attention was given them until the fall of the next year.
>
> In the fall they were examined and some trees found dead, some alive, with the knots alive, also—and some alive with the knots dead. This last named and much desired result has occurred with two trees treated with the saturated solution of cupric sulphate (bluestone) and with one tree, the only one, treated with dilute carbolic acid. The result encouraged me to make further tests with each of these two solutions. Not knowing yet whether it would be "kill or cure" with my medicine, I deemed it wise to treat ten trees only with the bluestone solution and five trees only with the dilute carbolic acid in the fall of 1891. At the end of

another year, I found these trees all living, with the knots dried up and dead. A difference, however, was observed between trees treated. Those treated with carbolic acid seemed to have suffered some in vitality and growth, and I noticed that certain roots were killed by the carbolic acid. In cases of bluestone treatment, the trees all appeared vigorous and healthy. I now felt that I could safely treat all my trees affected with root-knot, with an application of the bluestone solution.

Accordingly, on the 13th day of September, 1892, I set a man to work digging away the soil from all my prune trees on Myrobalan stock; those on peach stock were examined only long enough to prove that they were free from root-knot. Of five hundred trees on Myrobalan stock, about two hundred were found with root-knots. All such were treated with the bluestone solution. Our work was confined to the main root stem, including the forks of the root. We did not attempt to follow the roots in their ramifications after they leave the base of the tree. The principal damage from root-knot appears to occur only when the knots approach the crown of the root; when they encircle the crown of the root, the tree is hardly worth saving. Hence, where root-knots exist they should be destroyed early, at least before they encompass the root crown. As to the method of the work, I will say, that as fast as the knots were uncovered by the man with the shovel and trowel, I followed with brace and bit, and a large bottle of concentrated solution of bluestone. In the cork of the bottle a quill was fixed to guide the fluid easily in the bored holes. After two days' work this method of treatment was modified. A curious and interesting thing occurred. I noticed that the leaves on certain branches of trees treated the first day had turned very dark, with a sort of coppery tint which was very noticeable. These leaves dried up shortly and fell off, leaving the branches naked, while other branches on the same trees retained their green leaves. Not one tree only, but a score of them were showing this strange effect of the cupric solution. With those dead, copper-hued leaves before my eyes, there was little room for doubting that the cupric fluid had thus quickly entered into the circulation of the tree. It must have done so to produce the effect observed. And it must have gone up at a season when we speak of the sap as going down. I was a little scared at this phenomenon, and modified my treatment by striking off the knots and puncturing the diseased wood, especially the core of the knot, with a sharp pointed iron, then applying the cupric solution with a swab—in this way avoiding too excessive a quantity of the fluid penetrating the fiber of the tree. However, in the light of future events, there seemed to be no need of this precaution. The trees thus curiously and it would seem seriously affected, were all right in bud, leaf, blossom, and fruit in the spring and summer following. They have shown no sign of injury since, but on the contrary seem to have taken on a healthier tone than the other trees, so that I now believe the treatment by boring is perfectly safe, if done in September or October. I could not vouch for it at other seasons of the year.

After two years not one of the two hundred trees has died. Every tree treated was marked by tying a strip of cotton cloth on a south side branch next to the trunk of the tree. These marks still remain. Only last week I dug away the earth from about twenty of these marked trees and found *dead* knots only. The trees treated for root-knot now look as clean and healthy as those not treated—no difference can be seen; they all made a splendid growth last year, and no finer trees of the same age can be seen in our section. In the light of these facts, I consider the treatment with bluestone, in the manner herein described, a success. Even if the knots should reappear after three or four years, it would still be profitable to apply this remedy to keep the knot growth in check. The cost of application need not be more than three to five cents per tree, and the bluestone used is so trifling in quantity that it need not be considered in the bill of expense. My treatment of root-knot has always been in the fall months of the year. Whether other seasons would do as well, or better, I am not prepared to say.

In using this remedy my advice is to make the bluestone solution as strong as the water will dissolve.

In applying the solution be sure that it penetrates the core of the root-knot.

If the knot is on the main stem of the root, so as to be easily accessible, I would advise knocking it off and puncturing the soft core repeatedly with any pointed instrument. Then apply the solution with a swab. Be thorough in having the solution penetrate the diseased wood.

In case the knot is difficult to reach—embedded between roots, or deep—bore into it with brace and small bit; aim at the core; then fill the hole or holes with the solution from a stoppered bottle with a quill in the stopper.

Examine your trees below the surface, if you have reason to suspect root-knot. Apply the remedy before the knots have reached the crown of the root and, by encircling the tree at this point, have permanently injured and dwarfed the tree. There comes a time when, if root-knots are neglected, the tree will not be worth saving.

ASPARAGUS RUST.

The culture of asparagus in this State during the past few years has been developing at a rapid rate, until now it is a very important industry, particularly on the bottom lands of the Sacramento and San Joaquin rivers.

Up to a very recent period asparagus was grown for local consumption, very little, comparatively, being shipped East. The earliest beds cultivated, of any great extent, were those located east of Agricultural Park in Sacramento, from which the markets of San Francisco were principally supplied.

But the area now in cultivation on the islands and mainland of Sacramento and San Joaquin counties is numbered by the hundreds and thousands of acres, and the quality of the vegetable is superior to any produced elsewhere. On Bouldin Island there is one bed of 1,000 acres, from which were shipped in one season over one hundred cars in the fresh state, besides hundreds of thousands of cases which were canned and shipped from the same field to almost every point in the world.

What has aided this industry in a great measure, besides the superiority of the asparagus produced here, has been the almost annihilation of the industry over nearly the whole region east of the Rocky Mountains by the asparagus rust (*Puccinia asparagi*, DC.), and the failure, thus far, to discover any efficient and practical remedy for it.

It first appeared in the asparagus beds on the Atlantic seaboard in 1896, being doubtless imported from Europe, where it has long been known, and has spread since that date over a vast area. The rust has been known to scientists for about one hundred years.

In Bulletin No. 129, of the New Jersey Experiment Station, is the following, relative to the asparagus rust:

"The rust is caused by a fungus, the mycelium of which grows beneath the epidermis, sapping the vitality of the plant, finally lifting and rupturing the epidermis as if blistered, giving a brown appearance to the plants, which is due to the multitude of spores borne upon the tips of fine threads of the fungus, which aggregate at certain points and cause the spot. The threads from which the spores are produced are exceedingly small and grow through the substance of the stem, taking up nourishment and causing an enfeebled condition of the victim, which results in loss of the green color and the final rustiness of the plant. These spores are carried by the wind to other plants, where new diseased spots are produced; but as the autumn advances a final form of spores appears in the ruptures that is quite different in shape and color from the first ones produced through the summer.

"There is another form of rust which the fungus assumes, not usually seen in the asparagus field, but which may be found in early spring upon plants that are not subject to cutting. This is the cluster-cup stage, so named because the fungus produces minute cups from the asparagus stem and in small groups of a dozen or fifty, making usually an oval spot easily seen with the naked eye. This stage of the fungus comes first in the order of time in the series, and is met with on volunteer plants that may grow along the roadside or fence row in a field where all the old asparagus plants have not been destroyed.

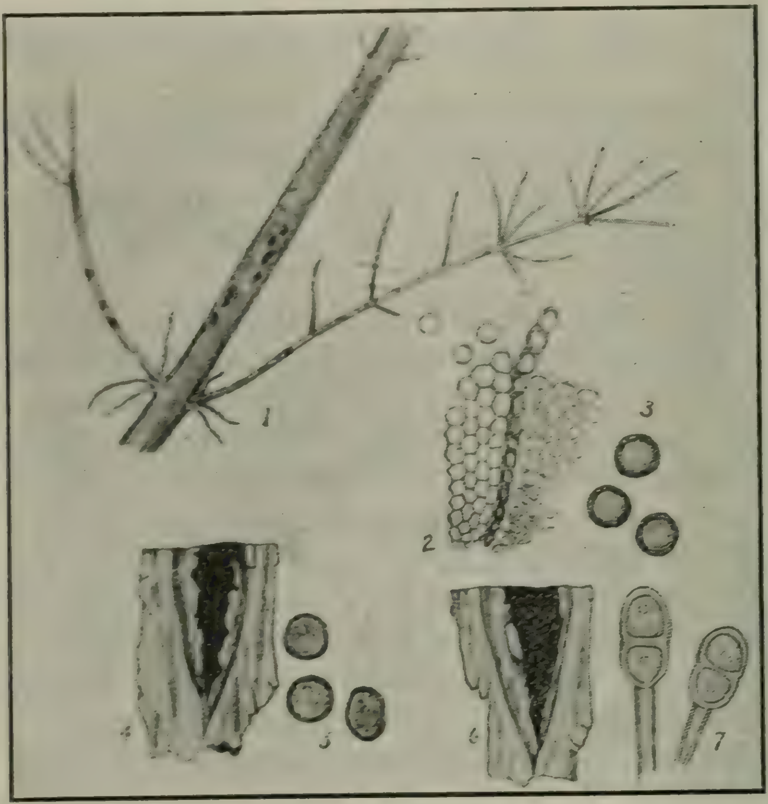


FIGURE 1.

1. General appearance of Asparagus Rust. 2. Æcidium or cluster-cup stage; 3. Spores; 4, 5. Uredo sorus and spores; 6. Teleuto sorus; 7. Teleuto spores. (1, King; the other figures after Halsted.)

"A parasite has been frequently seen upon the uredo form of the asparagus rust. This is a fungus bearing the name *Darluca filum*, Cart., that is well understood as preying upon the rusts generally. To the naked eye, the fungus, as seen in the field, gives the rusty plant a moldy appearance. This light gray color is due to multitudes of fine

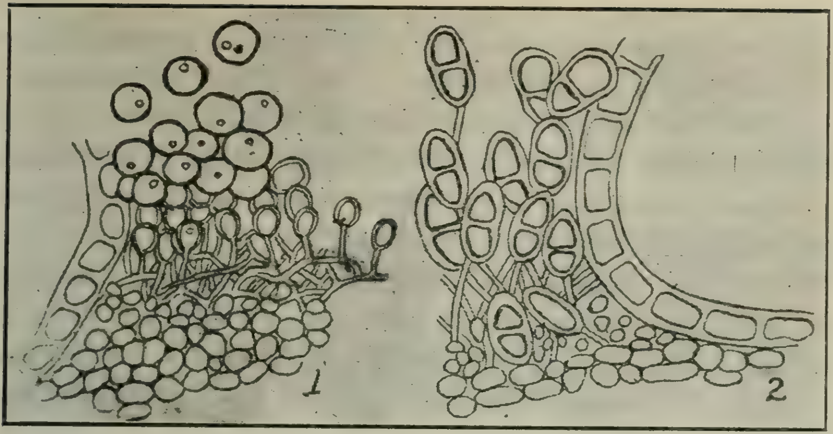


FIGURE 2.

1. Uredo sorus, with spores and mycelium. 2. Teleuto sorus and teleuto spores and mycelium. (After Halsted.)

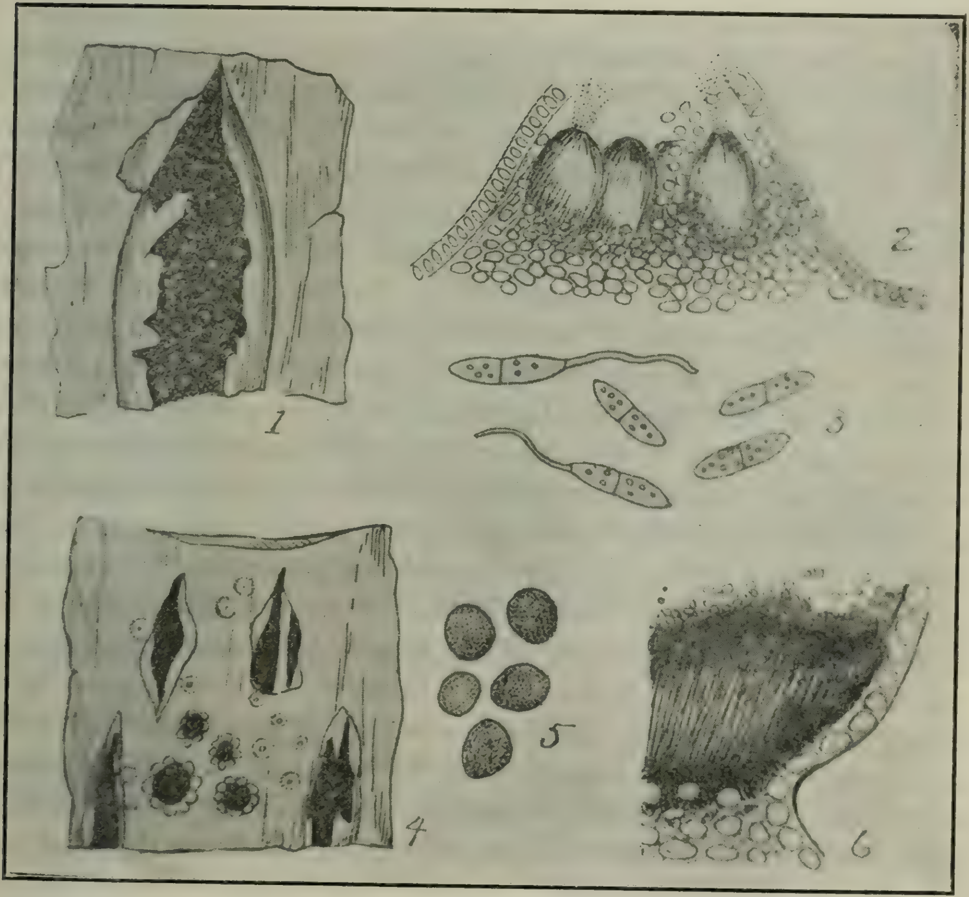


FIGURE 3.

1, 2, 3. *Darluca filum:* 1. Infected sorus: 2. Cross-section showing pycnidia and spores; 3. Spores magnified, two showing germ tubes. 4, 5, 6. *Tubercularia persicina:* 4. Parasite in sorus of rust; 5. Spores of parasite, magnified; 6. Section through sorus, showing parasite with spores. (After Halsted.)

curved threads that ooze out of the more deeply seated portion of the fungus. When these minute spirals, made up of spores that, with the accompanying jelly, are pushed out of the spore cavities, are washed away by rains, the stems appear covered with minute dark pimples, which are the spore cavities of the fungus. The fine threads of the *Darluca* fasten themselves upon those of the rust, and there finally result the structures for spore production.

"The two fungi, namely, the rust that feeds upon the sap of the asparagus, and the *Darluca* that gets its nourishment from the filaments of the rust, are quite unlike in many things. Both are fungi; both are found in the same diseased spots of the asparagus; but under the microscope the differences are as great as between asparagus and onions.

" In some localities, this parasite upon the asparagus rust has been so abundant as to make it difficult to find a fully developed rust spot free from *Darluca filum.* It is impossible to make any statement as to the favorable effect its presence may have on the following crop."

The Delaware Agricultural Experiment Station, in Bulletin No. 57, issued in June, 1902, recommends the following preventive measure:

" During the season of 1901 asparagus rust has not been as destructive as during the preceding summers, but has at all times been serious enough to command a careful consideration as to its control. The experiments conducted by the New York station, together with a trial made under the auspices of the Delaware station during the summer of 1901, warrant us in recommending Bordeaux mixture as a rust preventive. On account of the difficulty in getting the latter mixture to adhere to the foliage, it is advisable to use rosin soap at the rate of two pounds to the barrel. The rosin soap is prepared as follows: Dissolve seven pounds of sal-soda or washing soda in four or five gallons of water, and boil; then add ten pounds of rosin, and continue the boiling about half an hour, or until the rosin is completely dissolved, and there results a yellow soap in the bottom with a clear, brown supernatant liquid above. The supernatant liquid is poured off and the soap collected. Dissolve two pounds of the soap in the necessary quantity of water and add to the Bordeaux mixture, which is prepared in the ordinary way. The first application would be made in that section about the middle of July, and repeated two weeks later. The economical spraying of asparagus demands a specially devised spraying outfit, and should consist of a cart with wheels sufficiently high so that the axles will brush the tops of the spray. On this cart is mounted a barrel and a pump, the latter being connected with a length of pipe running along the back of the cart and parallel to the axles. To this horizontal pipe are attached three trees and short nipples, to which are attached the nozzles. By driving across the field in the direction of the rows a rather broad strip of plants can be sprayed as rapidly as it takes a horse to slowly pace the ground."

The above remedy or preventive is given as the best that has yet been devised to stay the progress of this rust. Its use has not proven entirely successful, reducing the damage on an average only about 25 per cent.

The following reports on the distribution of the asparagus rust are taken from a New Jersey Agricultural Experiment Station bulletin for 1901:

Professor Jones's report for Vermont is "that there has been less of the asparagus rust in this State than there was two years ago."

For Massachusetts, Professor Stone writes: "The rust has been prominent here this season, and there has been a slight tendency to its spread."

From Delaware, Professor Chester sends the following: "During the past two years it has not been as general and destructive as in the two preceding years, but all in all it is general throughout the State."

Professor Newton reports from Maryland that in some places the rust is abundant.

Professor Buckhout writes from Pennsylvania that "the asparagus rust is scarce this year—much less than before."

Professor Price, of Texas, writes: "I have found the rust in Texas for the first time this year."

Professor Selby, of Ohio, writes: "There appears to be no spreading of the rust."

Professor Wheeler, of Michigan, sends word that "the rust, so far as I can learn, is not on the increase."

Professor Goff, of Wisconsin, writes: "A single case of asparagus rust has been reported to me this season."

Professor Arthur, of Indiana, reports the rust as abundant as last season, and adds: "The infection of this region in general this year came largely or wholly from spores blown from considerable distances."

Professor Burrell reports for Illinois that "the disease has been spreading and is now known in at least a dozen plantations throughout the State."

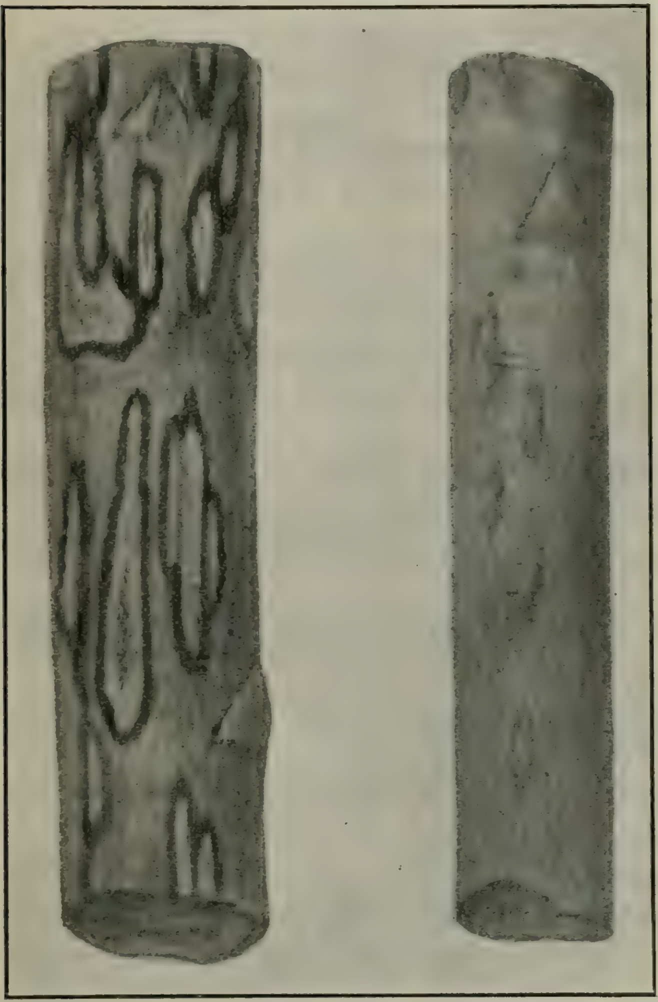
From Iowa, Professor Pammel writes: "I think the rust is on the increase, at least in this vicinity."

The Nebraska Experiment Station reports as follows: "From observations made near Lincoln, and from the reports that come in, there seems to be much less asparagus rust than last year at this time. Much of the brush that grew in the early part of the season was badly rusted, but the continued dry and hot weather of the summer helped to check it on a few small patches that showed rust."

Professor Saunders, of South Dakota, says: "I can not find that it is spreading. It was observed lately infecting a field near Yankton."

From Professor Bolley, of North Dakota, it is learned "that the disease did not make much headway upon the garden plot of asparagus until this last summer, when the attack was general and very destructive. The crop began to yellow in August, and by the last week in August, when it should have been very green, it was strictly brown and dried up."

From the foregoing it will be seen how wide is the distribution of the asparagus rust, and that the attempts to exterminate or prevent its spread have proven futile.



Leopard Spot. Rust.

FIGURE 4.

(Maryland Agr. Expt. Sta.)

Another fungous disease of the asparagus, which must not be confounded with the asparagus rust, has made its appearance in portions of the Atlantic seaboard. The accompanying illustration shows the difference in appearance. It is called the *Leopard spot*. Bulletin No. 50, of the Maryland Agricultural Experiment Station, gives the following description of the fungus:

"I have observed another fungus in the asparagus fields in Dorchester, Caroline, and Kent counties, that is equally as destructive as the rust. It belongs to the group of Anthracnoses, and is a new species. As yet it has not received a scientific name, but Dr. B. D. Halsted, of the New Jersey Experiment Station, who is working on this group, informs me that 'a description has been prepared, and after some further observation will be published.'

"Some asparagus-growers of this State have mistaken this disease for the work of the asparagus beetles. In general appearance the disease is very striking, the characteristic spots resembling the coat of a leopard, as shown in the left-hand figure of the illustration. I have therefore proposed to call it the 'asparagus leopard spot,' to distinguish it readily from the asparagus rust. By a little close observation this disease need not be confounded with injury by insects."

The asparagus rust appears in two or more stages, but it is the uredo or summer stage which causes the damage. The fall stage of the rust, known as the black or teleuto stage, causes no appreciable damage.

The Hatch (Massachusetts) Agricultural Experiment Station has thoroughly investigated the rust in that State, and has arrived at the following conclusions:

"The injurious effect of the rust has been confined to the dry, sandy soils possessing little capacity for holding water. Where the soil is heavier, possessing more water-retaining qualities, the rust has caused no perceptible harm.

"The injurious effect of the rust is apparent only when the summer stage occurs, viz.: the red spores, or uredo spores, which develop during July and August.

"The fall stage of the rust, known as the black or teleuto, has been prevalent all over Massachusetts since 1896, but this form has caused no appreciable damage and is disappearing.

"The practice of burning the tops in the summer has resulted in injury, and no benefit has manifested itself from burning in the fall.

"The results obtained by spraying asparagus are not encouraging.

"The various asparagus-beds on moist soils do not appear to be affected with the summer stage of the rust and consequently are not injured, being able, as it were, to resist the summer stage, although the tops of the plants are affected with the fall stage during their period of natural death.

"The best means of controlling the rust is by thorough cultivation in order to secure vigorous plants; and in seasons of dryness, plants growing on very dry soil with little water-retaining properties should, if possible, receive irrigation."

The same Experiment Station, in a bulletin issued in January, 1902, gives the status of asparagus rust in Massachusetts, as follows:

"In July and August outbreaks of the uredo stage were perhaps not so severe as a whole as in some years; nevertheless, it was severe enough to be likely to cause damage to the crop next year. The distribution of the rust in this State remains nearly the same as it has for some years, although there has been a slight tendency for the uredo stage to show itself in some beds which heretofore have never presented anything but the teleuto spore stage. * * * The young beds rust so much earlier than the old ones that they suffer more severely as a consequence, and in many cases are so weakened that it looks questionable whether they will ever develop into anything of value. * * * The teleuto spore stage appears to be widely distributed in this State, and has been from the very first. The question naturally arises, why do these teleuto-spore-infected beds not have a summer stage. * * * The principal and most important difference found in those beds which are subject to the summer and fall infection is one of soil texture and water-retaining capacity, which enable the plants, other conditions being equal, to remain vigorous during seasons of drought. When the asparagus rust first made its appearance there could be seen beds in which one portion was infected while the other showed not the slightest trace of disease. The only differences existing in the plants were their age and treatment. The differences of infection in their cases were due to different degrees of vigor. But such beds, being in regions where the soil is very sandy, subsequently became rusted."

The State Board of Horticulture of California, appreciating the impending danger to the asparagus industry of this State should the rust be introduced, passed a most stringent resolution, forbidding the importation of any asparagus roots and seeds from any quarter outside of the State, and the widest publicity was given to it. It is the only means by which the asparagus industry can be preserved in this State, and it is hoped that a willing compliance will be given to this resolution.

The rapid spreading of the asparagus rust since its introduction in 1896, and its wide distribution over so large an area, together with the impossibility (up to date) of exterminating it or even controlling it within reasonable bounds, prove it to be one of the most formidable pests that has ever threatened a single agricultural interest, and it is to be hoped that the measures taken by this Board to prevent its introduction into this State, supplemented by the efforts of our numerous Quarantine Guardians, will prevent its gaining a foothold here.

INSECTS OF THE YEAR.

A Review of the More Common Insects which have been Reported to the State Board of Horticulture During the Seasons of 1901-1902.

SOUTH AFRICAN BLACK-SCALE PARASITE.

(*Scutellista cyanea.*)

By ALEXANDER CRAW.

This interesting, curiously-shaped, chalcid fly was first described from Ceylon, where it was found on *Lecanium coffeæ.* It was later found in Italy attacking wax scales (*Ceroplastis rusci*). Through Dr. L. O. Howard's efforts it was introduced into Florida and Louisiana in 1898, to try it upon the wax scales of those States. I have no report from Florida, but in a letter from Prof. H. A. Morgan, Baton Rouge, La., dated February 6, 1902, he writes: "Several years ago I tried to introduce *Scutellista cyanea* here to work upon *Ceroplastis cirripediformis*, but got no results. I am anxious to try it again, and if your colony has increased sufficiently, can you not spare me a few?" As we have so much territory in California where the parasite is required, I have not yet sent Professor Morgan a colony, but will do so in the spring.

It was not until Professor Charles P. Lounsbury, Government Entomologist of Cape Colony, called attention to the *Scutellista cyanea* as an efficient enemy of the "black scale" (*Lecanium oleæ*) in that country, that its true value was recognized.

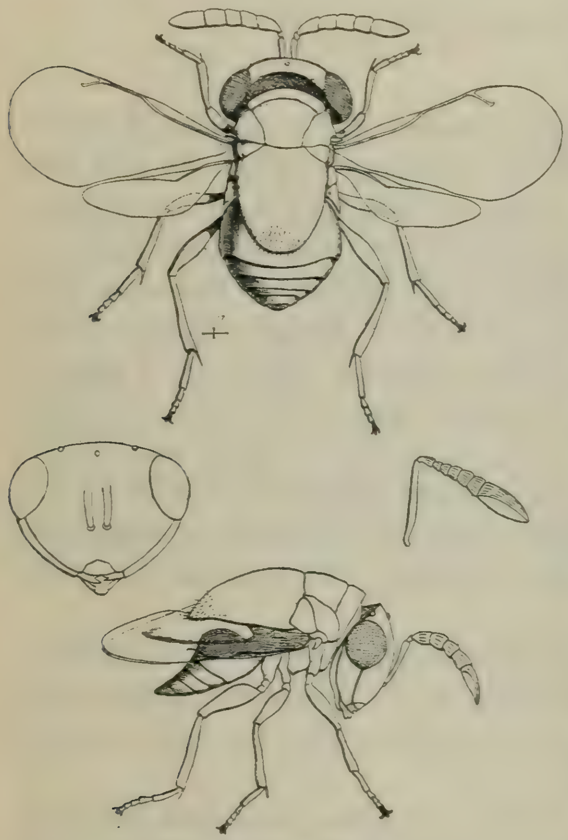
Through the efforts of the Hon. S. F. Leib, of San José, and Mr. E. M. Ehrhorn, of Mountain View, Senator Perkins appealed to the U. S. Department of Agriculture to use its good offices toward securing this valuable insect. Several colonies were forwarded to Mr. Ehrhorn, but unfortunately without any practical results from either sending. On October 1, 1901, Professor Lounsbury wrote me: "By to-morrow's boat we start to you two boxes containing cuttings of oleander bearing parasitized scale. It is not ideal material by any means and this is not the season we most wish to send in, but the scale and its parasites are both so scarce that we must send what we find as soon as we find it. Most of the scale in your vicinity will be old by the time this reaches you, but I am in hopes you may be able to get material from the south of the State that will take a generation of the parasite. Owing to the probable presence of secondary parasites, it is, of course, inadvisable to send the original material to any orchardist down there."

From this sending seventeen perfect insects developed, of which four were females. When placed in a breeding-case a small spider that was hidden in a rolled-up leaf, seized and killed one of the females, leaving us but three from which to colonize the State.

On December 26, 1901, I examined a full-grown black scale from the tree in the breeding-case, and found a small maggot of the *Scutellista cyanea*, about twice the size of a black-scale egg. This convinced me that they were breeding, so no further examination was made. On February 7, 1902, the parasites began to issue from the scales. During the warm summer months we find that the *Scutellista* passes through all its metamorphoses in forty-seven days.

Colonies have been sent to all the counties of the State where the black scale is troublesome. From personal examination and from material sent in, it is evident that the parasites have obtained a good start, and the coming season will, we hope, see them thoroughly disseminated.

Description.—In the female the antennæ are reddish-brown, with the ring joints and tips dark and more spreading than in the male. The antennæ of the male are black from the ring joints to and including the clubs, with the scape reddish-brown; the legs in both sexes are black, tarsi reddish-brown and claws black; the scutellum in both male and female is very large.



Scutellista cyanea.

Imported South African internal parasite of the black scale—greatly enlarged. (After Howard.)

(With permission of U. S. Department of Agriculture.)

As the flies are small and very active it is difficult to detect them upon the tree upon which they may be placed, and the best way to determine if they are established is to remove and examine the inside of the full-grown scales about forty to fifty-five days after liberating the parasites. The larva is maggot-shaped and white, this soon changing to the pupa, which is black just before changing to the perfect fly.

THE CALIFORNIA PEACH-ROOT BORER.

(*Sanninoidea opalescens.*)

By EDW. M. EHRHORN,
Entomologist of Santa Clara County, California.

California has had its share of insect pests as well as other States of the Union; but, fortunately for the grower, these pests, after doing considerable damage, have been eradicated or kept in check by various laborious means and, more recently, by predaceous and parasitic enemies. The grower, however, can never expect to be unhampered by these pests, for no sooner does one disappear for a season or two, than either it will return or another pest will take its place. We have found this to be the case with scale insects, and also find it to be the case with caterpillars, the various larvæ of our butterflies and moths.

The most serious pest of the orchards of some sections to-day is, without question, the peach-root borer (*Sanninoidea opalescens*). I should say California peach-root borer, to distinguish it from the Eastern species (*S. exitiosa*), a very closely allied species, which does considerable damage to peach orchards, and the habits of which are similar to those of our insect.

Our peach-root borer has been known for over fifteen years, but no experiments have ever been systematically carried on to effect its destruction. In looking up the records, we find the first mention of the pest was made by the late W. G. Klee in the year 1888, in the report of the State Board of Horticulture, 1887–1888, at which time he was Inspector of Fruit Pests for the State. He says: "My first information of this pest came from Mr. John Britton, Quarantine Guardian for Santa Clara County, who sent me, under date of May 22d, chrysalids and larvæ and a mutilated specimen of a female, mentioning in his letter that this borer had killed a number of trees and that a number of orchards were affected. In his company I visited, some days later, the locality, a couple of miles southeast of San José, and satisfied myself about the dangerous character of this insect." Continuing further on, he says: "Whence the insect came I can only conjecture, but the supposition is, that it is a native insect that has existed on some wild bush and gradually has taken to the peach trees in the neighborhood, according to the statement of Mr. Leigh, whose orchard has suffered for many years." Thus we see that the insect had existed as an orchard pest for a number of years before it was made known to the public, possibly spreading unobserved, instead of being eradicated at the start.

The various stages of the peach-root borer are not generally known to the grower. Only the borer or larva and the pupa have been noticed; very few being familiar with the adult insect, male and female, and the egg.

The following description of the different stages of the insect will aid those who are troubled with this pest, in detecting it:

Egg.—The egg is very minute, not exceeding ¼ mm. in length, oval, light brown in color, and, when seen through a lens, ornamented with hexagonal sculpturing. The eggs are deposited on the bark of the tree, at or near the surface of the ground; rarely they are laid high up on the trunk or even in the crotches of the tree. This last phase is generally found in the grafted trees, where gummy exudations have occurred and where grafting has somewhat soured the sap.

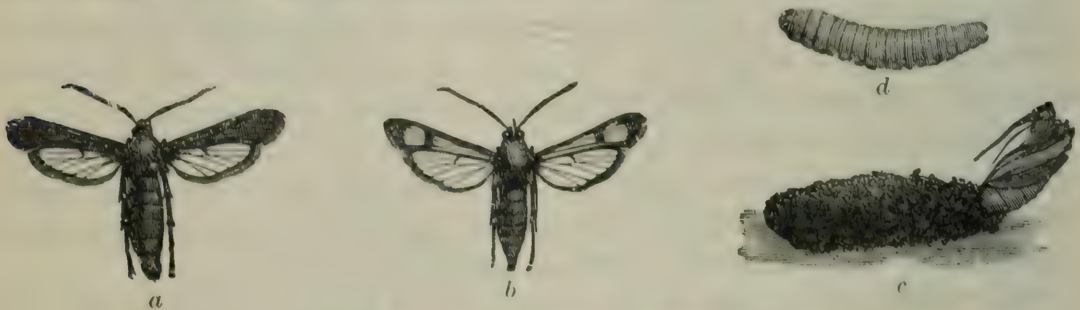


FIG. 1. PEACH-ROOT BORER. (*a*) Female. (*b*) Male. (*c*) Pupa. (*d*) Larva.

Larva.—The young larvæ, on hatching, are very active and immediately burrow into the tree, generally entering the cracks in the bark at or below the surface of the ground. Here they remain, constantly feeding on the bark, at first near the surface, surrounding themselves with gum, or coagulated sap, and gradually enter the sapwood, enlarging their burrows as they increase in size. The full-grown larva (Fig. 1, *d*) is pale yellow, about one inch long, tapering, with a brown head. After attaining its growth, the borer ascends in the burrow to or above the surface of the ground, as the case may be, and begins to spin a cocoon.

The Cocoon.—This is made up of a silken web mixed with castings and earth glued together, and is of a brown color, from 1¼ to 1½ inches long. (Fig. 1, *c*.)

Pupa.—The pupa within the cocoon is shiny, light brown, with numerous spines on the abdomen. When about to emerge the pupa is pushed out of the cocoon, as in Fig. 1, *c*, and soon the adult moth emerges.

The Moth.—To the novice this insect would appear more like a blue wasp than a moth. The female (Fig. 1, *a*) differs so much from the male (Fig. 1, *b*) that they might be taken for two distinct species. The female has bluish-black, opaque front wings, while the hind wings are transparent, like those of a wasp; the margin of both wings has a bluish-black fringe; antennæ, head, thorax, and abdomen are very dark steel blue, almost black; wing expanse, 1½ inches. The male (Fig. 1, *b*) has forewings nearly transparent, with upper margin and tips black; hind wings are transparent, like those of female; the body is bluish-black; the abdomen is much narrower than that of female and more elongated; legs are black, with yellow tufts on femur and tibia; wing expanse, 1¼ inches.

This insect differs very much in looks from the Eastern peach-root borer, which, as far as my observations go and according to Dr. L. O. Howard, of the U. S. Department of Agriculture (Bulletin 176, Cornell University Agricultural Experiment Station), does not exist on this Coast.

On several occasions imported trees from the Eastern States have been found infested with the larvæ of *S. exitiosa*, but through careful inspection and destruction these were not distributed; nevertheless, we should be on our guard. The female differs from the Californian in having a broad orange band in the middle of the abdomen and is a more slender insect. The larvæ of the two species are very hard to distinguish from each other, but the habit of the California species, which makes almost vertical burrows, while the Eastern species girdles the tree, might be used as a guide.

The food plants of the California peach-root borer, when first discovered, were the peach and cherry root. In the report of the State Board of Horticulture of the tenth Fruit-Growers' Convention, I find, in an essay by Mr. Klee, the following remarks. After he tells of his first notice of the pest near San José, he says: "If plum root is or is not attacked, we have not been able to prove conclusively, as we saw very few trees on plum root in the immediate neighborhood; but there is a strong probability that both plum and apricot are resistant. This matter requires thorough investigation, and I intend to try the experiment of colonizing the borer on plum root."

I can not find any record of Mr. Klee's experiment, but I can say, and all who have dealt with the borer know, that it will attack peach, almond, apricot, cherry, and plum roots, although the plum root (Myrobalan) is not so badly attacked as the others.

In regard to the development of the insect, from the egg to the adult, we are as yet somewhat in the dark. The Eastern species requires one year to complete its life circle. I believe the California species does the same, but our climatic conditions and the variety of food have caused the insect to have several broods. The moth in Santa Clara County has been observed flying at intervals from April to the end of October, which indicates that the species in this State has probably three or four broods. To still further prove this, I have found in one tree three distinct sizes of larvæ, viz.: newly hatched, half grown, and full grown. It is this fact that causes many failures in subduing the pest, as I will explain later on.

Mr. Klee reported the moth as appearing in May and June. This year (1902) I collected cocoons about the first of April, from which the moths emerged about April 15th. We find full-grown larvæ in some sections of the country and newly-hatched or half-grown larvæ in other sections, at the same time of the year. Here another danger lies, for if trees from these two places should be exchanged, by nursery stock being sold from one to the other, we will readily see why, in some sections, we find different broods present.

This pest spreads in various ways, but probably the most common method is in the transportation of infested nursery stock. It behooves the grower to be very particular in this respect, and those who are planting peach, plum, prune, apricot, almond, or cherry trees, should examine all trees carefully before planting, for if once the pest gets a foothold in a new locality it will soon spread, at first very slowly, but fast enough to cause great expense and much annoyance. This spreading is done by the female, which is very active and flies readily and swiftly, but does not fly a very long distance.

The Peach-root Borer's Life.—As stated above, very few have taken the pains to study the peach-root borer, and know it only as a borer—the larva of the insect—and have sometimes found the cocoon, which is the dormant state of the insect. They have not seen the egg, and least of all the moth, the cause of the whole trouble. This insect, like most other insects, begins life as an egg. These eggs the female lays probably in a few hours after copulation, and they are laid singly and in groups, in all sorts of places, at or near the surface of the ground on the bark of the tree. A female moth may lay from two hundred to five hundred eggs, but fortunately not all hatch, many perishing through some cause or other. In the Eastern States it is claimed that the young larva hatches in from eight to ten days after egg-laying. In California this has not yet been observed, but probably it takes about the same time, although I believe that climatic conditions have a great deal to do with the length of time.

The young borer begins feeding from the outside bark, generally starting in minute cracks, and gradually works its way to the sapwood, where it increases in growth and makes its burrow. Here it remains for from ten to eleven months, doing great damage to the bark, and when numerous larvæ are present, often causing the death of the tree. Large quantities of gum collect on the bark about the burrows, and this is a sure indication that the pest is present. During the cold winter months the larvæ do not grow much, but as soon as the sap begins to flow, they grow rapidly and soon attain their mature state. They then begin to ascend in the burrow and get near or above the surface line and spin the cocoon, which is still hidden in the burrow or under a piece of dead, loose bark. Before the larva makes a cocoon it bores an exit in the bark, near which it starts to spin. Soon the larva turns to a pupa within the cocoon, and, depending on climatic conditions, remains dormant for from ten days to four weeks. When the pupa is mature, it moves itself, by aid of the spines on the abdomen, out of the cocoon enough to project half its length (Fig. 1, *c*) so as to allow the moth, which is very delicate, to emerge without difficulty. The moth soon bursts through the pupa skin, which splits down the center of the back for a short distance. After carefully drawing out its legs and by aid of these its body, it may crawl a short distance and rest until its wings expand and dry. It is then ready to fly off and find its mate. After mating, the female soon lays the eggs, as stated above, and its life circle is completed. It is very easy to tell whether or not the moth of the peach-root borer has hatched in the orchard by the empty projecting pupa skins. (Fig. 2, *p*.)

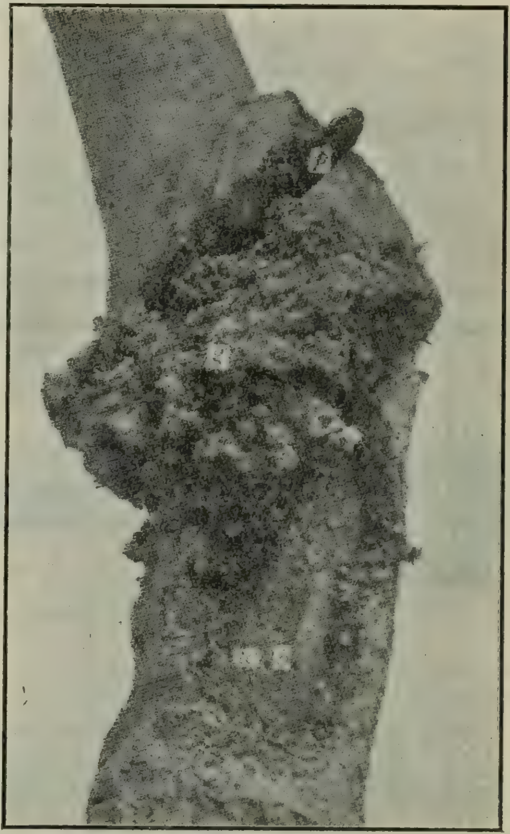


FIG. 2. Work of a single borer in a peach tree; natural size; (*w b*) burrow of borer; (*g*) gummy mass; (*p*) pupa projecting from cocoon. (After Slingerland.)

METHODS OF DESTROYING THE PEST.

As I have stated before, the peach-root borer has been known for over fifteen years in this State, and for fifteen long years the grower has fought it in every conceivable way. Many different remedies have been used and recommended, and still the pest is with us, as numerous as ever and attacking more varieties of roots now than when first recorded.

As the larva or borer (Fig. 1, *d*) presents the most vulnerable stage of the insect's life, the most successful attack is made at this stage. The methods for fighting it are twofold, viz.: preventive and destructive. In discussing these methods it will be well for us to begin with the latter. The destructive measures used against the borer are either the tedious way of digging it out with a knife or chisel or with an especially made instrument (Fig. 3), or by the use of strong washes applied to the trunk and roots below ground, or by the fumes of carbon bisulphide.

In looking over the various remedies which have been used since the insect became known, I find the following which have given good results:

The Digging-out or Worming Method.—The digging-out or worming method is no doubt the surest way to know that the borers are killed, provided that good conscientious workers can be had. The best time to do the work is in November or December. The soil, which should be moist enough to crumble, is removed from around the tree and the bark scraped free from all clinging materials, such as gum and earth. With a knife or chisel, or, still better, the regular tool (Fig. 3), composed of hook, scraper, and chisel, the search for the borer is made. First find a channel and follow it up or down, using the hook, and locate the borer. Make a thorough search for every one until you are satisfied that all borers are out of the tree. Care should be exercised not to take too much bark off—only the necessary quantity to get the borers out. The trees may be left open for a few days, especially if moist weather prevails, and then can be covered up until spring, when some preventive may be used, as shown later on. Some growers have dug for borers twice a year, generally in May or June, with good results. Shallow-rooted trees are attacked more severely than trees planted deep; and trees with root-knot are also favorite places for the borer to thrive.

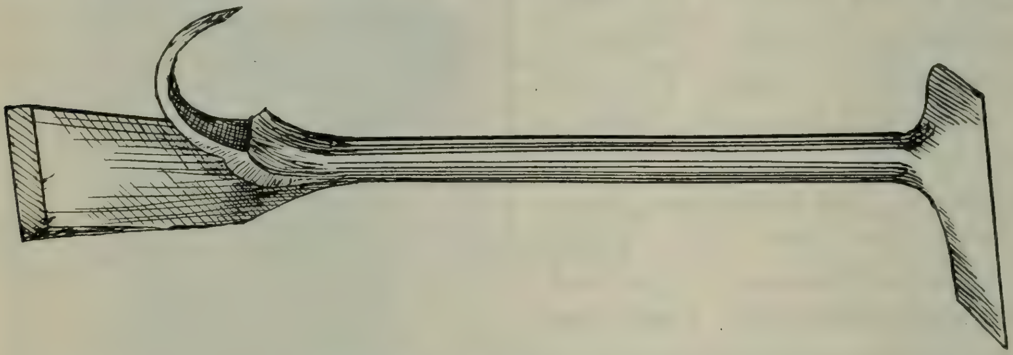


FIG. 3. Instrument for digging out peach-root borers.

Carbon Bisulphide.—To get the best and quickest results from the carbon bisulphide fumes, the soil surrounding the tree should be as loose as possible. To accomplish this, remove the soil from the base of the tree as shown in diagram (Fig. 4, D). It should be from six to eight inches from the bark to the edge of the trench, and as deep as there are indications of the borer; the gummy masses and castings indicate the location of the borer (Fig. 4, A and B). Then this trench should be filled up to the level with some mellow soil from the surface of the ground, as is shown in diagram (Fig. 5, E). Now we are ready to put the carbon bisulphide around the tree; from one and one half to two and one half ounces are used according to size of tree. It is safest not to put the liquid on the bark, but about one and a half or two inches from it, as indicated in Fig. 6, at F. After the liquid has been put around the tree as directed, it should be immediately covered with six or eight inches of pulverized soil and pressed down with a shovel, as indicated in Fig. 6, G. If these directions are followed there is no reason for failing to kill the borer. Experience has taught us that the fumes will remain about the tree for from a few days to a couple of weeks, and if rain should fall after the application, some damage may result. We therefore recommend the removal of the soil from the trench, after a few days; or if rain should follow the application, the soil should be removed at once. A few years ago, in 1896, when this remedy was first introduced by Mr. Cragin, people were too anxious to try it, and, in the endeavor to do a good job, overlooked some important points; the result was some damage to a number of trees. Since that time, however, some of our more careful and experienced orchardists have tried the liquid and would not use anything else now. This remedy, applied in November or December and followed with the lime, coal tar, and whale-oil soap wash, as a barrier, will reduce this terrible pest.

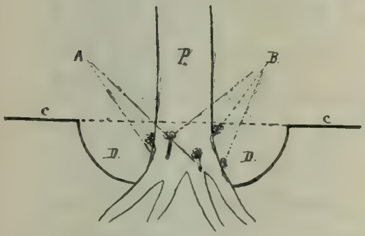


FIG. 4.

P. Peach tree.
A. Burrows of borers exposed.
B. Gum and castings.
C. Surface of soil.
D. Trench.

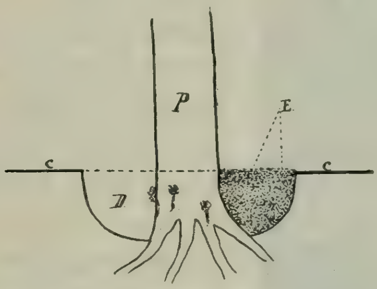


FIG. 5.

E. Mellow earth filled in trench.

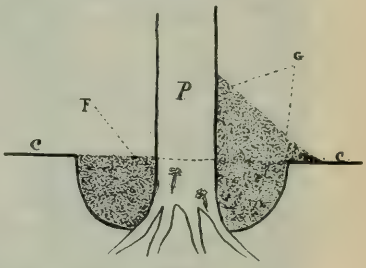


FIG. 6.

F. Location to put carbon bisulphide.
G. Soil covering carbon bisulphide after application.

Strong Washes.—Some caustic soap washes have been tried against the borers without first digging them out. Although in some cases such treatment has worked well, mostly where young larvæ exist, yet for the old larvæ it will not give results which would warrant the cost of the wash and the labor. In the Eastern States coal tar or gas tar is used in this way, and from reports received, good results have been obtained, even with nearly full-grown borers. In California we have always been warned against the use of this material, owing to our dry, hot climate, yet some very good results have been obtained when the tar was kept below the ground. We have had damage where the tar was put on the body of the tree, even only a few inches above the ground, still sufficiently exposed to the hot weather to drive the oils into the bark and wood so as to kill portions of the tree.

Tobacco.—During the spring of 1902 I applied some tobacco dust to a few badly infested trees, and on examining them this fall I found but two borers in six trees treated. I found that the bark and earth touching the bark had been saturated with the liquid tobacco. I shall try further experiments next spring and hope for better results. I used about half a pound to the tree, and this was covered over so as to prevent the wind from blowing it away. In the Eastern States tobacco was used by binding tobacco stems (the midrib of the tobacco leaf) around the trunk and then covering with earth. Some good results were obtained, and it is thought that the liquid, which the moisture brings out of the stems, did the killing. Tobacco dust and stems can be had at any of our cigar factories; stems sell for one cent a pound and less, tobacco dust for two cents a pound.

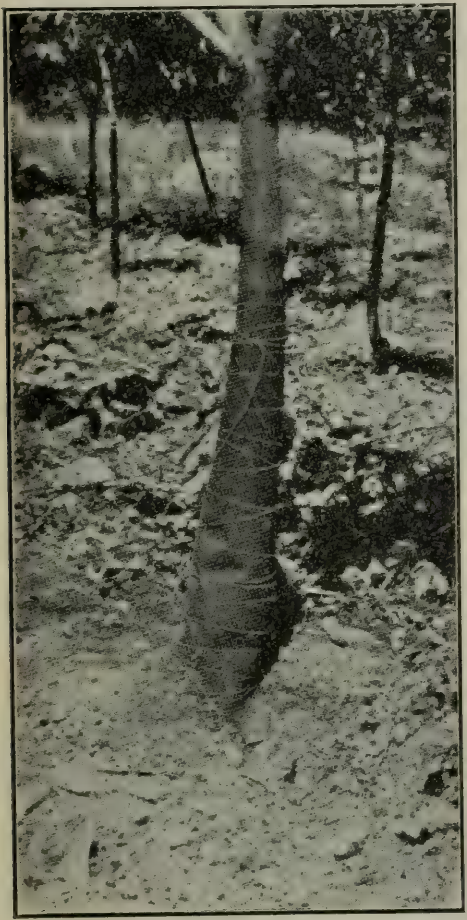


FIG. 7. Peach tree treated with tarred paper. (After Slingerland.)

Gas Lime.—Some years ago it was thought that gas lime would be a good remedy and would likely kill the borer in the burrow. Experiments were tried, with fatal results to the tree. I mention this, as on several occasions inquiries as to this material have been received.

PREVENTIVE MEASURES.

Preventive measures or barriers are substances which prevent the young larvæ from entering the tree, and it has been the endeavor of the experimenter to find some substance which would be least affected by rain and which would yield as much as possible to the expansion of the trunk of the tree.

Paper.—Good paper has lasted better than many other barriers, and very successful results have been obtained. We have, however, had also great failures, and these can be attributed to the fact that the small borers—those that are just beginning to enter the bark—were not taken out of the tree. As I have stated above, these small borers are very often overlooked, and if inclosed under any paper barrier will continue feeding and doing damage, which will be discovered when the paper is removed in the fall. Some failure may be attributed to weather conditions (rain and wind), which soften the paper and cause it to become torn in places, allowing the borer to enter unobserved. If paper is to be used, good stout paraffine paper is the best. Enough soil should be removed from around the tree so that the paper can be put at least six inches below the surface; it should also be placed at least eighteen inches up on the trunk. The paper should be tied with cotton string in several places, to hold it tightly around the tree; and it should be either folded upon its edges or given a broad lap (Fig. 7). These barriers should be put on about the middle of March, and this may be said of all preventives or barriers; the object being to have the tree protected before the moths fly.

Lime, Coal Tar, and Whale-oil Soap.—Probably the best preventive used to-day is a compound of the following ingredients:

Unslaked lime	50 pounds.
Coal tar	1½ gallons.
Whale-oil soap	12 pounds.

To make the compound, slake the lime and tar together, adding enough water to make a moderately thick whitewash. Dissolve the soap with *hot* water and add this to the lime solution, adding enough water to make a thick, paste-like whitewash. For economy, some fine sandy soil may be added to make quantity, but not too much, otherwise the compound will become too brittle when dry, and will lose its purpose. Paris green and sulphur have been added to the above compound, but experience has shown that no results have been brought about by this addition, so that the money spent is only wasted.

I may mention here that the mounding process—the piling of earth around the tree—has been tried here, but owing to the different habits of our species, it does not work as well here as it does in the Eastern States. All preventives should be used with the destructive methods and applied as directed above. Trees must be treated every year as long as this pest appears in a locality, otherwise it will never be kept in reasonable check so as to give the grower peace.

During the period 1888–1902 the following articles have been published in the more important reports, bulletins, and agricultural papers:

1888. W. G. Klee. A treatise on the insects injurious to the fruit and fruit trees of the State of California.

1888. Biennial Report of the State Board of Horticulture. Report of W. G. Klee, State Inspector of Fruit Pests.

1889. Essay by W. G. Klee. Official report of the Tenth Fruit-Growers' Convention.

1889–90. Biennial Report of the State Board of Horticulture. Insect Pests.

1891. D. W. Coquillett and C. V. Riley. Insect Life, Vol. III, p. 292. Discussion.

1891. A. Craw. Bulletin 58, California State Board of Horticulture. Peach-tree borers infesting deciduous trees.

1894. A. Craw. Bulletin 68, California State Board of Horticulture. Insect pests and remedies.

1895–96. A. Craw. Biennial Report of the State Board of Horticulture. Remedies and preventives.

1898. E. M. Ehrhorn. Pacific Rural Press. The crown-borer of the peach.

1899. E. M. Ehrhorn. The Twenty-fourth State Fruit-Growers' Convention. Discussion on peach-borers.

1900. A. Craw. Bulletin 71, California State Board of Horticulture. Insect pests and remedies.

1898–1901. Carroll Fowler. Report of Agricultural Experiment Station, University of California. The peach-tree borer.

INSECTS AS DISTRIBUTERS OF HUMAN DISEASES.

For centuries it has been observed that where the ground was low and marshy, interspersed with stagnant pools of water, the people living in such localities were more subject to malarial diseases than were those living in higher and drier places. In such marshy places mosquitoes were also abundant, and it was the consensus of opinion that the exhalations from the marshes caused disease. The mosquitoes were only deemed an incident, but recent scientific investigation and experiment have proved beyond the shadow of a doubt that were the mosquitoes eliminated there would be no malarial disease. That a person may live in malarial places and enjoy perfect immunity from intermittent fevers, if he stays in doors at night, protected from swamp emanations only by wire gauze on open doors and windows, has been proven by repeated experiments.

The attacks of mosquitoes cause almost intolerable suffering and annoyance to man and beast in some places. It is stated that when the mosquito inserts his proboscis into a warm-blooded animal it also at the same time injects a poison that sets up a local inflammation, which causes the blood to flow to that place, thus enabling the mosquito easily to obtain a supply of blood and which afterward causes the painful and disfiguring blotches on the person attacked.

It was not until 1882 that the idea that mosquitoes conveyed the malarial germ and deposited it in the human blood was promulgated. In 1900 an Italian, Grassi, proved by experiments that if persons were protected from the bites of certain mosquitoes they would not be afflicted with malaria. Afterward two English physicians, Sambon and Low, in the autumn of 1900 lived in a home in the most malarial portion of the Compagna. The house was thorougly screened from mosquitoes. During their entire stay they were free from malaria and chills, while the people living in unprotected houses were suffering from chills and fever. At the same time an Anopheles mosquito that had bitten a malarial patient was sent to England and allowed to bite a person who probably never had malaria, at least not since childhood, and in course of time he developed a typical case of malaria.

It has been determined that the germ causing malaria passes certain phases of its life history in a particular kind of mosquito, and certain other phases of its development in the blood of the human body. After passing through these stages in the mosquito it is injected by that insect into the human blood, there to pass other stages of its development by which malaria is produced.

In an experiment conducted in one of the Southern States a building of one large room was constructed in a notoriously malarial swamp. The room was equally divided in the middle by mosquito netting, and in half of the room, protected from mosquitoes, were placed six men. In the other half of the room, which was unprotected, were placed six men. All had previously been examined by a physician and found in perfect health. In the course of time, five of the six men in the unprotected part of the room were affected with malaria, while the six men in the part of the room protected from mosquitoes remained healthy.

The relation of mosquitoes to yellow fever has been shown by the following experiment made in Cuba by a medical commission from the United States Army, and published in Bulletin No. 74 of the Mississippi Agricultural Experiment Station:

"In a field near Quemados, Cuba, the commission of surgeons erected a small wooden building, tightly ceiled and with the windows and doors closely screened so that no mosquitoes could enter. In this house during a total of sixty-three days seven non-immune men were kept. They used the unwashed pillow slips, sheets, and blankets that had previously been used on the beds of genuine yellow fever patients in Havana and elsewhere. Neither during that time nor subsequently did one of these seven men develop a case of yellow fever.

"Another house was built in this same field and divided by wire screen from floor to ceiling into two rooms. The doors and windows were closely screened with fine wire netting so that no mosquitoes could enter. All bedding and material carried in was disinfected by steam. In one of these rooms mosquitoes of a certain kind that had previously bitten patients with yellow fever were placed. In the other room none were allowed. Non-immunes were placed in both rooms. Of those in the room containing no mosquitoes, none had yellow fever. Six out of seven of those in the other room that were bitten by mosquitoes developed cases of genuine yellow fever. This would seem to indicate almost conclusively that mosquitoes of a certain kind are responsible for the transmission of yellow fever from one individual to another."

As further proving that yellow fever can be conveyed by mosquitoes we take the following extracts from Bulletin No. 96 of the Kentucky Agricultural Experiment Station: "Upon the recommendation of Surgeon-General Sternberg, a medical board was appointed to study yellow fever in Cuba, consisting of Drs. Reed, Carroll, Agramente, and Lazear. Two members of the board, Drs. Lazear and Carroll, allowed themselves to be bitten by mosquitoes that had previously bitten yellow fever patients. Both became affected with the disease, the former losing his life."

Another experiment was as follows, which it would seem conclusively proves that the germs of yellow fever are conveyed alone by mosquitoes:

"The board had erected a frame house, such that mosquitoes could not enter, and styled it 'Building No. 1,' or the 'Infected Clothing and Bedding Building.' On November 30, 1900, this building was provided with bedding soiled by contact with yellow fever patients at the Los Animos Hospital, Havana, Cuba, and at Columbia Barracks, some of it purposely and freely soiled, and in the evening after unpacking it and shaking it in the air of the room to liberate the germs of yellow fever should any be present, Dr. R. R. Cooke and two privates of the hospital corps, all non-immune Americans, made up their beds of this clothing and slept there and continued to do so thereafter until December 19, 1900, adding to their equipments, on December 12th, bedding so offensive that its odor compelled them to retreat for a time from the house. Though spending twenty nights in this house, all three remained in good health. Subsequently other non-immune Americans occupied this building, using even undershirts that had been worn by yellow fever patients, and in not a single instance was yellow fever contracted.

"In a second building, known as 'Building No. 2,' or the 'Infected Mosquito Building,' all articles used were carefully disinfected by steam, after which infected mosquitoes were introduced."

Comparing the results of the experiments made in the two houses, the board in the bulletin referred to reports:

"Nothing can be more striking and instructive as bearing on the cause of house infection in yellow fever than when we contrast the results obtained in our attempts to infect buildings Nos. 1 and 2; for, whereas, in the former *all* of seven non-immune men escaped the infection, although exposed to the most intimate contact with the formites (soiled clothing) for an average period of twenty-one nights each, in the latter an exposure reckoned by as many minutes was quite sufficient to give an attack of yellow fever to one out of two persons who entered the building, or fifty per cent."

While in California there is little danger from yellow fever, the above experiments are given to show that some diseases are carried by insects, and further research and experiment may show that many other epidemic diseases are distributed in the same manner.

The following is an article from the Yearbook of the U. S. Department of Agriculture, written by Entomologist L. O. Howard, Ph.D.:

"In very many parts of the country the farming population has to contend with at least two diseases which are preventable. These are malaria and typhoid fever. Both of these diseases are transferred, or may be transferred, by insects—malaria by certain mosquitoes, and typhoid fever by the common house fly, or certain other flies.

"While it is true that both malaria and typhoid prevail in large cities, it is none the less true that they may, with a certain degree of accuracy, be termed country diseases; that is to say, rather specifically, diseases of the farm and small village. Malaria, in fact, has been called by the medical men a country disease. Swampy regions do not occur in cities, or, at all events, only in the suburbs, whereas they occur commonly in the country. Open streams with side pools of still water are found only in the country, and it is in such still, small pools, and in more or less permanent but small accumulations of water, that the malarial mosquito breeds. This mosquito, therefore, does not accommodate itself well to city conditions, but is found almost everywhere in the country, except possibly in very dry localities and at certain high elevations. Even in dry regions it sometimes abounds, especially where there is a definite rainy season, or where the land is irrigated. Irrigating ditches are prolific breeding-places for mosquitoes, including the malarial kind. Malaria, in cities, as a rule, is found only with persons who have contracted it in the country or in the suburbs, although with some cities having marshy places on their borders a malarial belt may exist, the extent of which depends upon the direction and force of the prevailing summer breezes, especially the night breezes. For example, such a condition as this accounts for the prevalence of malaria in certain portions of the city of Washington before the reclamation of the Potomac flats, which lie to the south of the city, the prevailing night breezes of the summer being southern.

"Cities well supplied with water from a reservoir, especially with a filter reservoir, which possess a modern sewage system, and in which water-closets are universal, derive typhoid fever only from the following sources: Contaminated country milk, the return of the people in the autumn from the less sanitary country, and lack of care in the disposal of the discharges of persons who have contracted typhoid from either of the first two sources.

"In the country, however, conditions are different. Each country house or each house in a small village has its own water-supply, usually in the shape of a well; the cattle get water from the streams; there are no water-closets, and excreta are deposited in the open or in box privies; drainage from these box privies or the open deposits containing virulent typhoid germs may enter the streams, be carried for some distance, and be taken into the stomachs of cattle all along the course of the stream, or the germs may be carried by underground drainage directly into the wells from which drinking water is gained; or, exposed as these box privies or open deposits are, certain flies may light upon the excrement and carry the germs directly to the food-supply of the houses; or certain flies may breed in this excrement and fly, fairly reeking with disease-bearing filth, to the kitchens and tables of nearby houses. When we consider that active typhoid germs may be given out for some time by persons who have not developed typhoid fever sufficiently so that it may be recognized, and that they may also be given out for some time after patients have been apparently cured of the disease, it is perfectly obvious that in the country the lack of care with which excreta are deposited readily accounts for outbreaks of typhoid fever from any of the causes mentioned.

"Of course it will be said that the entire water-supply of a city may become contaminated at or immediately above its reservoir supply. This contamination is from country sources and might be obviated either in a general manner by the establishment of a reservoir filtering plant, or in a special manner by individual householders by the constant and thorough use of house filters. In cities possessing a common water-supply and modern sanitary plumbing there is no excuse for the presence of typhoid in the household. Even the city water must be filtered, which can be done by the use of any one of the cheap filters now in the market; the milk which is drunk by children must be sterilized, and the excreta of persons returning to the city, after contracting typhoid fever in the country, must be disinfected with the utmost care. These three measures, systematically followed, will result in the abolition of typhoid fever within the city boundaries. So much for cities. In the country the matter is somewhat more difficult, and immunity from malaria and typhoid depends largely upon the individual householder. Such immunity may be obtained, but only as a result of intelligent care.

"Let us briefly consider what the farmer or resident of a small village must do to bring about protection.

"The old idea that malaria is caused by breathing the miasma of swamps has been exploded. Malaria is contracted only through the bites of mosquitoes of the genus Anopheles. The cause of human malaria is the growth and development, within the red-blood cells, of a very minute parasitic organism belonging to the lowest group of the animal kingdom—the group Protozoa, or one-celled animals, which includes those minute creatures known as Amœbas and others, and which live in the water or in damp sand or moss, or inside the bodies of other animals as parasites. This parasite reproduces in the body by subdividing, eventually bursting the red-blood cells and entering the blood serum as a mass of spores. Broadly speaking, when the blood of a human being is sucked into the stomach of a mosquito of the genus Anopheles, the malarial parasite undergoes a sexual development and gives birth to a large number of minute, spindle-shaped cells, known as blasts, which enter the salivary glands of the insect and are ejected with the poison into the system of the next person bitten by the mosquito. If this person happens to be non-malarious the malaria has thus entered his system and malarial symptoms result. So far as present knowledge goes, this is the only way in which people become malarious. In order to avoid this result it is necessary to avoid the bites of malarial mosquitoes, and it therefore becomes important to know the differences between the malarial and the more harmless mosquitoes, and the conditions under which the malarial forms breed.

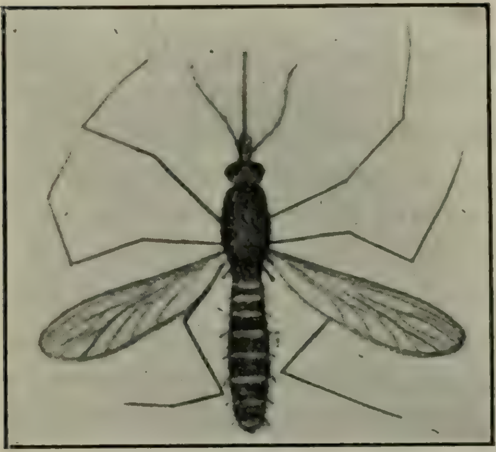


FIG. 1. Adult female of *Culex pipiens;* enlarged. (Miss. Agr. Expt. Sta.)

"There are very many mosquitoes which have not yet been proven to carry any disease. In fact, the majority of mosquitoes are supposed to be harmless except for the irritation caused by their punctures. The commonest of all forms belongs to the genus Culex. These include the mosquitoes most commonly breeding in rain-water barrels and chance transient pools. Culex, the harmless mosquito, has clear wings, while Anopheles, the malaria bearer, has wings which are more or less spotted. Further, while the palpi (which are projections on either side of the beak) are very short in Culex, they are long—nearly as long as the beak—in Anopheles; and, further, it has been observed that when Culex is resting upon a wall it appears more or less humpbacked, that is to say, the head and beak are not in the same plane with the body and wings, but project at an angle toward the surface of the wall, the body and wings being parallel with the wall. With Anopheles, however, the head and beak are in practically the same plane with the body, and the body itself is usually placed at an angle with the wall, and especially when resting upon a horizontal wall, such as the ceiling of the room, the body of the Anopheles is at a very great angle with the surface. We have in this country three species of the malarial genus Anopheles, namely, *Anopheles maculipennis*, *Anopheles punctipennis*, and *Anopheles crucians;* the two former are found nearly all over the country, but the

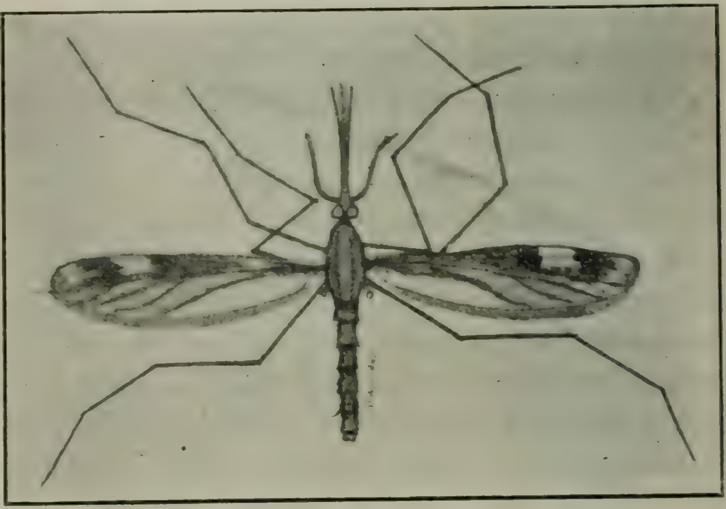


FIG. 2. Female of *Anopheles punctipennis;* enlarged. (Miss. Agr. Expt. Sta).

last is a more Southern species, although it has been found as far north as the south shore of Long Island. As to the early stages, the eggs of Anopheles may at once be distinguished from the eggs of Culex, those of Culex being laid in a raft-shaped mass on end and those of Anopheles being laid singly upon the surface of the water, always lying upon their sides. The larvæ of Culex, commonly known as wigglers, are familiar to almost every one, and are the common wigglers found in horse-troughs and rain-water barrels, which wiggle around in the water, returning at intervals to the surface to breathe, and when at the surface hanging with simply the tip of the tail extruding, the rest of the body being held below the surface at a great angle. What we have called the 'tail' is simply the breathing tube, which, with the common Culex wigglers, is long and more or less pointed. With the malarial mosquitoes, however, the wiggler, or larva, is of somewhat different shape, and when resting at the surface, which it does most of the time, it lies with its body parallel with the surface, and not hanging down, as does the Culex wiggler.

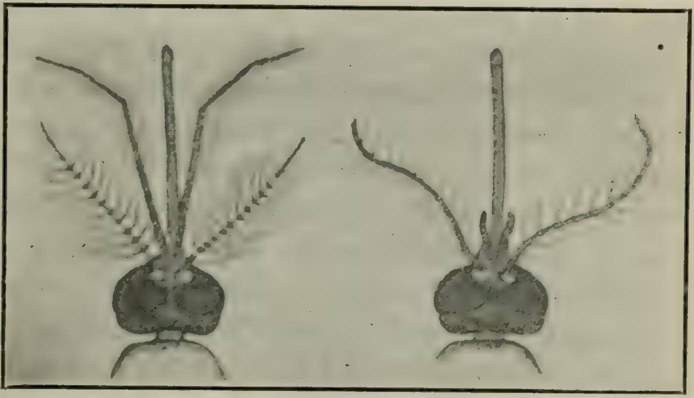


FIG. 3. At left, head of male Culex; at right, head of female Culex. (Miss. Agr. Expt. Sta.)

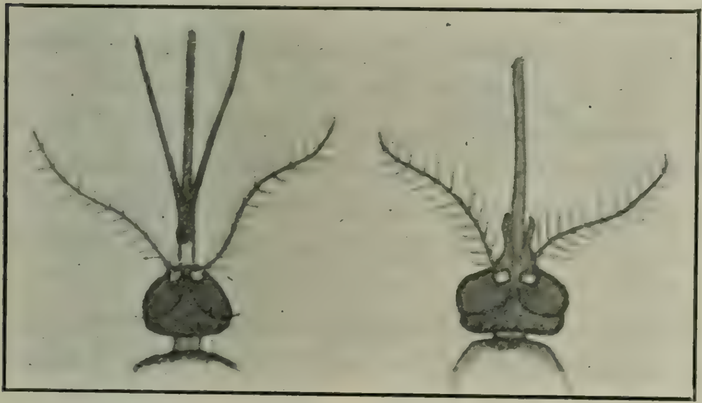


FIG. 4. At left, head of Anopheles, showing appendages; at right, head of Culex, showing appendages. (Miss. Agr. Expt. Sta.)

"The breeding-places of the harmless mosquitoes are more numerous and more varied than are the breeding-places of the malarial mosquitoes. Anopheles, however, are found under many divers conditions. They are found, as stated, in still side pools of small streams, in the swampy pools at the margins of larger ponds, in stagnant water in ditches, in the beds of old canals, in the still water at the sides of springs, and occasionally, though rarely, in old horse-troughs. They are perhaps more frequently found in such situations as described when a certain amount of green scum has accumulated, and it is upon the spores of the water plants constituting this green scum, as well as upon other very small objects floating on the surface of the water, that they principally feed.

"To prevent malarial mosquitoes from breeding in a given vicinity, one should be prepared to recognize their larvæ when they are seen, and to distinguish them from other mosquito larvæ; then a most thorough search for all possible breeding-places should be made within a radius of a mile. This distance is mentioned, since it seems rather definitely proven that the Anopheles mosquitoes do not fly for great distances. After the breeding-places are found they should be drained or filled in with earth, or they should be rendered uninhabitable to the Anopheles larvæ by covering the surface of the water with a thin film of kerosene oil, or by introducing certain fish which feed upon the larvæ, such as top minnows, sticklebacks, young sunfish, or goldfish.

"Pending the result of such exterminating measures, all houses in malarious localities should be carefully screened to prevent the entrance of mosquitoes. After screening, thorough search should be made in the house for mosquitoes which have already gained entrance. Such as are found roosting upon the walls should be captured by placing an inverted vial over them, or they may be stupefied by burning a small amount of pyrethrum powder upon a tin dish cover. Persons wishing to avoid malaria should not sit out of doors at night exposed to the bites of mosquitoes. Persons having malaria should be carefully screened at night to prevent them from being bitten by mosquitoes, which, becoming thus infected, would become potential carriers of the disease. Such patients, systematically treated with quinine, the dose being always given at the beginning of the chill, will soon be rid of the disease. The time of the dose is important, and the reasons for the time have been abundantly proven by the study of the life of the parasite in the blood cells.

"All of this advice is given only after abundant demonstration of the efficacy of the methods. These efforts have been followed with success in the most malarious districts in the world, and with this knowledge there is no good reason why any individual should contract malaria in his own home, no matter how much malaria exists around him.

"Of course, however, there may be occasions where it is almost impossible to avoid contracting the disease. For example, last October, the writer was waiting for a night train one evening in a small Western town where there were irrigating ditches near the station. In these ditches malarial mosquitoes were breeding profusely and the insects abounded in the station waiting-room and on the platform. Nothing but a gauze covering would have kept them away, and several bites were inflicted on the hands and neck. Fortunately, none of the individuals could have bitten a malarial patient, as the disease was not transmitted.

"It is not the writer's intention to go further into the causation of typhoid fever than he has already done in his introductory remarks. He wishes, however, to point out as forcibly as possible the danger of its spread by insects and the methods of avoiding this danger.

"The principal insect agent in this spread is the common house fly, and this insect is especially abundant in country houses in the vicinity of stables in which horses are kept. The reason for this is that the preferred food of the larvæ of the house fly is horse manure. House flies breed in incredible numbers in a manure pile largely derived from horses. Twelve hundred house flies, and perhaps more, will issue from a pound of horse manure. Ten days completes a generation of house flies in the summer. The number of eggs laid by each female fly averages about one hundred and twenty. Thus, under favorable conditions, the offspring of a single over-wintering house fly may in the course of a summer reach a figure almost beyond belief. With an uncared-for pile of horse manure in the vicinity of a house, therefore, flies are sure to swarm. Their number will practically be limited only by breeding opportunities. They are attracted to, and will lay their eggs in, human excrement. Under favorable conditions they will breed, to some extent, in this excrement. They swarm in kitchens and dining-rooms where food-supplies are exposed. They are found commonly in box privies, which are sometimes not far distant from the kitchens and dining-rooms. Therefore, with an abundance of flies, with a box privy near by, or with excremental deposits in the neighborhood, and with a perhaps unsuspected or not yet fully developed case of typhoid fever in the immediate neighborhood, there is no reason why, through the agency of contaminated flies alighting upon food-supplies, the disease should not be spread to healthy individuals. That it is so spread is not to be questioned. That under the unusual conditions of the army concentration camps in the summer of 1898 it was so spread to a shocking extent has been demonstrated by the army typhoid fever commission. And the remedy is plain. It consists of two courses of procedure: (1) Proper care of excreta; (2) The destruction of flies.

"On many farms where intelligent people live, the old-fashioned box privy has been done away with, and there has been substituted for it some form of earth closet. Where a good earth closet is in operation and the inhabitants of a farm appreciate the importance of using no other, and where in case of illness the excreta of patients are promptly disinfected, flies breeding in the neighborhood will have practically no opportunity to become contaminated with typhoid germs, except in the unlikely event (which further investigation may possibly show) that other animals than man are subject to this disease. The proper maintenance of an earth closet will add somewhat to the work of a farm, but this extra work will pay in the long run. While it is true that a box inclosure, if its contents are covered with lime every three or four days, will answer the purpose, a much better plan would be to use a large metal vessel, the surface of the contents being covered with earth after each operation and which may be removed, emptied, and replaced daily. Care should, of course, be taken to empty the contents of the vessel in a pit constructed in some well-chosen spot, from which the drainage would not be dangerous. With regard to the abolition of flies, the best measures will again naturally involve some trouble and expense. In a thickly settled country it will become necessary for some such measure to be generally adopted in order to be perfectly effective, but in an isolated farm-house the number of house flies may be greatly reduced by individual work. All horse manure accumulating in stables and barns should be collected, if not daily, at least once a week, and should be placed in either a pit or a vault or in a screened inclosure like a closet at the side or end of the stable. This closet should have an outside door from which horse manure can be shoveled when it is needed for manuring purposes. Each day's or week's accumulations after they are shoveled into the closet or pit, should be sprinkled over the surface with chloride of lime, and a barrel of this substance can be conveniently kept in the closet. If this plan be adopted (and these recommendations are the result of practical experience) house flies will have almost no chance to breed, and their numbers will be so greatly reduced that they will hardly be noticeable. Many experiments have been made in the treatment of manure piles in order to kill the maggots of the house fly, and the chloride-of-lime treatment has been found to be the cheapest and most efficacious. It has been stated above that the closet for the reception of manure should be made tight to prevent the entrance or exit of flies. A window fitted with a wire screen is not desirable, since the corroding chloride fumes will ruin a wire screen in a few days.

"While extended investigations have shown that the common house fly is the fly most to be feared in guarding against typhoid, on account of the fact that over ninety-nine per cent of the flies found in kitchens and dining-rooms and attracted to food-supplies are house flies, there are a few others which are attracted to and which may breed in human excrement that also have to be guarded against, and as these do not breed in horse manure the treatment just described will not be effective against them. The care of human excrement, however, will prevent the carriage of typhoid germs, even by these species. The little fruit flies of the genus Drosophila, which breed in decayed or over-ripe or decaying fruit, are the principal species in this category. Therefore, fruit storehouses or fruit receptacles should be screened and overripe fruit should not be allowed to remain in dining-rooms or kitchens for any length of time.

"While in malaria and typhoid we have two principal diseases common to the United States which may be conveyed by insects, the agency of these little creatures in the transfer of disease germs is much more widespread in warm countries, and it is by no means confined to human beings. In Egypt and in the Fiji Islands there is a destructive eye disease of human beings the germs of which are carried by the common house fly. In our Southern States an eye disease known as pink eye is carried by certain very minute flies of the genus Hippelates. In certain tropical countries a disease known as filariasis, which somewhat resembles certain forms of leprosy, is transferred among human beings by certain mosquitoes. There is good reason to suppose that the germs of the bubonic plague may be transferred from sick people to healthy people by bites of fleas. The so-called Texas fever of cattle is unquestionably transferred by the common cattle tick, and this was the earliest of the clearly demonstrated cases of the transfer of disease by insects. In Africa a similar disease of cattle is transferred by the bite of the famous biting fly known as the tsetse fly. The germs of the disease of cattle known as anthrax are carried by gadflies, or horse flies, and when these flies subsequently bite human beings malignant pustules may result. And other discoveries of this nature are constantly being made. Even the common bedbug is strongly suspected in this connection.

"One of the most important of these disease-transfer relations of insects which has been demonstrated is the recently-proved carriage of yellow fever by certain mosquitoes. The cause of yellow fever has always been a mystery, and, indeed, it is a mystery to-day in a measure, since although undoubtedly a disease of parasitic origin, the parasitic organism itself has not been discovered. During the summer and autumn of 1900 and spring and summer of 1901 the work of a commission of surgeons of the United States Army has demonstrated in Cuba beyond the slightest possible doubt that yellow fever is not conveyed by infected clothing of yellow-fever patients or by contact with such patients or by proximity to them, but that it is conveyed by the bite of a certain species of mosquito known as *Stegomyia fasciata*, which abounds in regions where yellow fever is possible. The bite of this mosquito, however, does not convey yellow fever to a healthy person until twelve days have elapsed from the time when the same mosquito has bitten a person suffering with the disease. It follows from this fact that by keeping yellow-fever patients screened from the possibilities of mosquito bites we can prevent the yellow-fever mosquito from becoming infected. It follows further that by preventing healthy people from being bitten by mosquitoes we can keep them free from the disease, even where infected mosquitoes exist. And it follows still further that by the adoption of remedial measures looking toward the destruction, in all stages, of the yellow-fever mosquito we may reduce to a minimum the possibilities of the transfer of the disease. After demonstrating the fact, the medical officers of the army in Cuba have put these measures into effect and the results have been most gratifying. The health of Havana has constantly improved, and at the date of present writing the public statement has just been made that during the month of October, 1901, there was not a single case of yellow fever in Havana, while October is usually the severest month for that disease, and in fact during the past ten years the average number of deaths in the city during that month from yellow fever has been 66.27. This discovery, and this practical demonstration of its truth, it seems must soon change all methods of quarantine in the United States, and it seems certain that in the future the Gulf cities will no longer dread the disease or remain subject to the great vital and economic loss to which they have been subject from occasional yellow-fever outbreaks during past generations."

GRASSHOPPERS, OR LOCUSTS.

During the season of 1902, portions of California, chiefly isolated tracts of the Sacramento and San Joaquin valleys, were threatened by apparently dangerous numbers of locusts or grasshoppers, and fear was felt and prognostications made that the damage from their depredations would be large.

On their appearance in some places the plan of destroying them by burning-over the fields of grass which harbored them was advised and carried out, leading in some cases to personal encounters, in others to the arrest of parties engaged in firing the fields or ordering it done, and in still other cases suits for damage have been threatened or commenced.

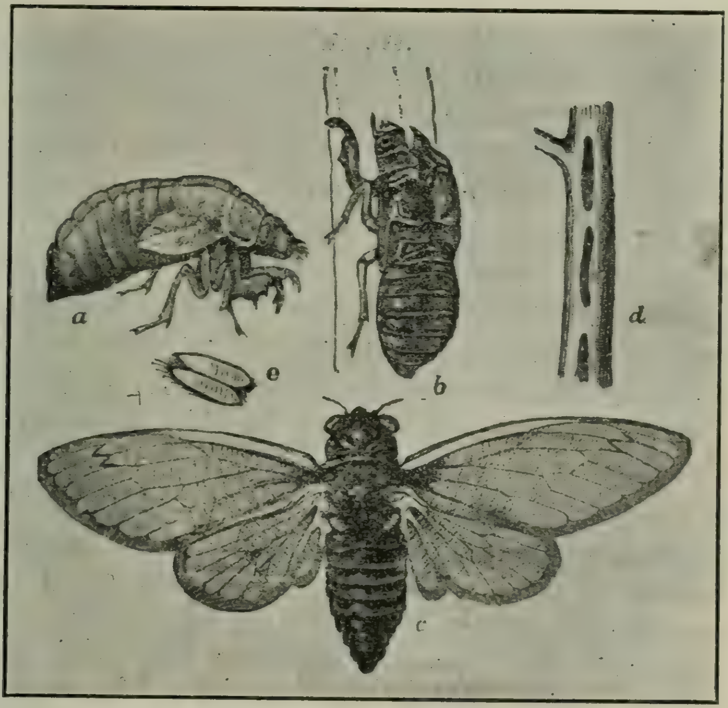


FIG. 1. THE PERIODICAL CICADA (*C. septendecim*).
(*a*) Pupa ready to change; (*b*) Pupa skin from which the adult (*c*) has emerged; (*e*) Eggs taken from the egg-punctures (*d*).

Fortunately the losses from the ravages of the grasshoppers were small; the damage resulting from the ill-advised and dangerous plan of setting fields afire at such a dry season as prevails in this State in the months of June and July, for the purpose of destroying the grasshoppers, we believe greatly exceeded any damage caused directly by the insects.

Alarm was increased by the publication, in some newspapers, that the plague with which we were afflicted was the seventeen-year locust, whose appearance had been predicted in some of the States east of the Rocky Mountains. Such predictions were without foundation, because the seventeen-year locust has never been known to exist in an arid or semi-arid region. This locust confines its movements to the moist eastern portions of this country, and in the northern part has a periodicity of seventeen years and in the southern part one of thirteen years. It belongs to a different order of insects—the Hemiptera; is called Cicada (Fig. 1), and has transparent wings, like the common house fly. The damage which it causes results from the female making slits in small trees or twigs in which to deposit her eggs, and which often destroys young trees. The only representative we have on this Coast is a Cicada known as the "Harvest Fly," or "Jarr Fly," which appears annually, but never in any great numbers; it causes no appreciable damage, and its high, sharp trill is only occasionally heard in warm, late summer days issuing from a clump of bushes or weeds.

The illegality of burning grass on pasture lands infested with grasshoppers, without the consent of the owners, having been declared in an opinion given by the Attorney-General, at the request of the Secretary of this Board, more reasonable means were devised for combating the threatened plague, and this Board had "hopper-dozers" made and ready for distribution when a demand should be made for them. Advice was also given to use poisoned bran according to the formula of this Board. The "hopper-dozers" were distributed on application, but as the applicants were few in number, it is evident that the grasshoppers did not exist in many localities or at least not in dangerous numbers.

The locust, or grasshopper, from which the most danger was apprehended is known as *Melanoplus devastator*, closely allied to the *Melanoplus spretus*, the destructive Rocky Mountain locust. There is no reasonable apprehension, however, that the destruction in California can ever be at all comparable to that caused by the Rocky Mountain locust in some of the Western States and Territories.

There is another grasshopper, belonging to the genus *Pezotettix*, which sometimes causes a limited amount of damage in this State. This species is generally found in shady localities, in low swales where the ground remains moister and the vegetation greener than on the high lands, and along the banks of streams. It is this grasshopper which sometimes frequents alfalfa fields. Its wings are short and rudimentary, resembling the wing-pads of immature winged grasshoppers, but it is very active and capable of jumping long distances. There are many other varieties in this State which sometimes aid in causing damage.

California has in the past suffered from devastating hordes of grasshoppers in several localities. Bulletin No. 25, of the U. S. Department of Agriculture, cites a number of instances. There were no means of positively identifying the species that committed the ravages, but it is probable that *Melanoplus devastator* was responsible for the largest share of the damage, no doubt assisted by other species.

In 1722, 1746, 1749, 1753, 1754, 1765, 1767 grasshoppers appeared in California. (A. S. Taylor, Smithsonian Report, 1858.)

The following, up to 1885, are from the same authority:

1823. Franciscan Missions of Upper California.

1827 or 1828. "Ate up all the growing crops."

1834 or 1835. "Destroyed the crops of the rancheros or missions, with the exception of wheat."

1838–1840. For these three years destroyed the crops and gardens about San Francisco and San Rafael.

1846. Corn and frijoles consumed on the Salinas plains.

1852. Near Centerville, Alameda County, California, and also in Oregon. They were noticed in the same locality every year since, up to 1897, but in very moderate numbers. (Lorenzo G. Yates.)

1855. The most noted year for ten years on the Pacific Coast—California, Oregon, and Washington. Great damage and many immense flights witnessed in this region.

1856. Lower California; small numbers.

1859. Pitt River Valley, California.

1862 or 1863. Hornitos.

1866 or 1867. Swarm fifteen miles wide seen near Stockton, California.

1869. Tulare County, California.

1873. Lower and Southern California.

1877. Fresno County, California.

1885. San Joaquin Valley of Northern California; Southern Oregon.

Another species—the Pellucid locust (*Camnula pellucida*)—has occasionally committed ravages in this State. In 1878 immense swarms appeared in the Sierra Valley, and in 1877 and 1879 they ravaged this coast near Santa Barbara.

There have been other instances of ravages by grasshoppers in California, causing considerable local damage.

From the foregoing record it will be seen that farmers and horticulturists should be prepared to successfully combat grasshoppers, when a season favorable for their propagation in destructive numbers arrives. It would be wise for farmers to observe where they oviposit, and to take measures to destroy their eggs before they are hatched, which is the most effective of all measures to prevent future damage. The places selected by grasshoppers for oviposition are always on ridges not subject to overflow, where the ground is firm but not too hard; they never oviposit in adobe or loose, sandy soils, or where vegetation is dense.

Bulletin No. 55, of the Minnesota Agricultural Experiment Station, contains the following description of the oviposition of the Rocky Mountain locust, which is applicable to ours: "The holes for the reception of the eggs are made by means of two pairs of horny valves at the tip of the abdomen of the female. These open and shut rapidly and are well adapted to execute this function. The female, by pressing the tip of her abdomen forcibly against the soil, rapidly opens and shuts these hard-pointed valves and soon pushes them into the ground, thus drilling a hole. In a short time the entire and greatly extended abdomen is inserted in the little curved and more or less oblique cavity. The legs are hoisted above the back during the operation of drilling this hole, which requires more or less time, depending entirely upon the character of the soil. As soon as the hole is finished it is filled with a frothy and mucous material."

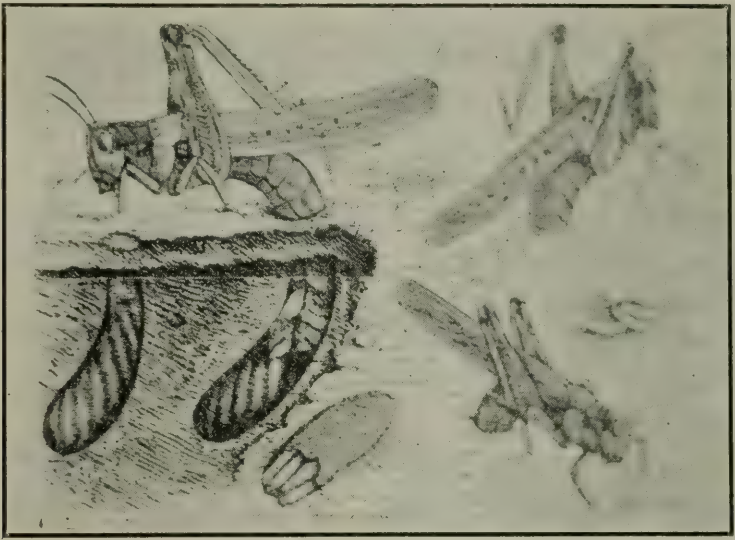


FIG. 2. ROCKY MOUNTAIN LOCUST OVIPOSITING.
(*a*, *a*) Females with abdomen inserted in the soil; (*b*) An egg-pod broken open and lying on the surface; (*c*) A few scattered eggs; (*d*) Section of soil removed to show eggs being put in place; (*e*) An egg-pod completed; (*f*) An egg-pod sealed over.

Professor Riley describes the method of egg-laying, as follows: "By repeatedly extracting and studying specimens in every stage of oviposition, we have been able to ascertain the exact method by which the egg mass is formed. If we could manage to watch a female from the time the bottom of her hole is moistened by the sebific fluid, we should see the valves all brought together, when an egg would pass down the oviduct along the ventral side, and, guided by a little finger-like style, pass in between the horny valves, and issue at their tips amid the mucous fluid already spoken of. Then follows a period of convulsions, during which more mucous material is elaborated, until the whole end of the body is bathed in it, when another egg passes down and is placed in position. These alternate processes continue until the full complement of eggs are in place, the number ranging from twenty to thirty-five, but averaging about twenty-eight. The mucous matter binds all the eggs in a mass, and when the last is laid, the mother devotes some time to filling up the somewhat narrower neck of the burrow with a compact and cellular mass of the same material, which, although light and easily penetrated, is more or less impervious to water, and forms a very excellent protection. When fresh the mass is soft and moist, but it soon acquires a firm consistency."

It is obvious that the best method of exterminating or reducing the number of grasshoppers would be to destroy the eggs or prevent their hatching, which could be done readily by plowing the ground in the fall or winter and thoroughly harrowing, which would break many of the eggs, or would bury them so deeply that the young in their weak state when first hatched would be unable to reach the surface, and would thus perish.

Like all other insects, grasshoppers in growing have to molt or shed their skins, which is done from three to seven times in the different species. But, unlike many insects, they have no period of quiescence, or only for a short time; they are active and voracious at all stages of growth. The young grasshopper differs but slightly in appearance from the adult, except in size, the most striking variance being in the absence of wings or only rudimentary ones. The wings first appear as small pads and gradually become larger after each molt, until the mature stage is reached, when the insects are prepared for flight.

The following graphic description of the last molt is from the First Annual Report of the U. S. Entomological Commission:

"When about to acquire wings the pupa crawls up some post, weed, grass-stalk, or other object, and clutches such object securely with the hind feet, which are drawn up under the body. In doing so the favorite position is with the head downward, though this is by no means essential. Remaining motionless in this position for several hours, with antennæ drawn down over the face, and the whole aspect betokening helplessness, the thorax, especially between the wing-pads, is noticed to swell. Presently the skin along this swollen part splits right along the middle of the head and thorax, starting by a transverse, curved suture between the eyes, and ending at the base of the abdomen. Let us now imagine that we are watching one from the moment of splitting. As soon as the skin is split, the soft and white fore-body and head swell and gradually extrude more and more by a series of muscular contortions; the new head slowly emerges from the old skin, which, with its empty eyes, is worked back beneath, and the new feelers and legs are being drawn from their casings and the future wings from their sheaths. At the end of six or seven minutes our locust—no longer pupa and not yet imago—has its four front pupa legs generally detached and the insect hangs by the hooks of the hind feet, which were anchored while yet it had that command over them, which it has now lost. The receding skin is transparent and loosened, especially from the extremities. In six or seven minutes more of arduous labor—of swelling and contracting—with an occasional brief respite, the antennæ and the front four legs are freed, and the fulled and crimped wings extricated. The soft front legs rapidly stiffen, and, holding to its support as well as may be with these, the nascent locust employs whatever muscular force it is capable of to draw out the end of the abdomen and its long hind legs. This in a few more minutes it finally does, and with gait as unsteady as that of a new-dropped colt, it turns around and clambers up the side of the shrunken cast-off skin, and there rests while the wings expand and every part of the body hardens and gains strength—the crooked legs straightening and the wings unfolding and expanding like the petals of some pale flower. The front wings are first rolled longitudinally to a point, and as they expand and unroll, the hind wings, which are tucked and gathered along the veins, at first curl over them. In ten or fifteen minutes from the time of extrication, these wings are fully expanded and hang down like dampened rags. From this point on, the broad hind wings begin to fold up like fans beneath the narrower front ones, and in another ten minutes they have assumed the normal attitude of rest. Meanwhile the pale colors which always belong to the insect while molting have been gradually giving away to the natural tints, and at this stage our new fledged locust presents an aspect fresh and bright. If we now examine the cast-off skin, we shall find every part entire with the exception of the rupture which originally took place on the back; and it would puzzle one who had not witnessed the operation to divine how the now stiff hind shanks of the mature insect had been extricated from the bent skeleton left behind. They were, in fact, drawn over the bent knee-joint, so that during the process they were doubled throughout their length. They were as supple at the time as an oil-soaked string, and for some time after extrication they show the effects of this severe bending by their curved appearance. The molting, from the bursting of the pupa skin to the full adjustment of the wings and the straightening of the legs of the perfect insect, occupies less than three quarters of an hour, and sometimes but half an hour. It takes place most frequently during the warmer part of the morning, and within an hour after the wings are once in position the parts have become sufficiently dry and stiffened to enable the insect to move about with ease; and in another hour, with appetite sharpened by long fast, it joins its voracious comrades and tries its new jaws. The molting period, especially the last, is a very critical one, and during the helplessness that belongs to it the unfortunate locust falls a prey to many enemies which otherwise would not molest it, and not infrequently to the voracity of the more active individuals of its own species."

In 1855 grasshoppers in immense swarms invaded Sacramento and the districts along the river adjacent to the city, causing considerable damage to the few farmers then in this locality; but there has been no visitation since that date. Their breeding-grounds were probably only a few miles east of the city, on then wild land, but now under cultivation. From this fact, we believe that their migrations seldom extend many miles from their breeding-places; but possibly lack of food, favorable winds, etc., may sometimes cause them to move considerable distances.

Grasshoppers in this locality usually make their appearance during the latter part of May, and in the following months of June and July cause their greatest devastation. After that time, effects of disease, attacks of natural enemies, and their extension over a wider area so reduce their numbers in a given locality that their depredations are comparatively so small as to be unnoticed.

Grasshoppers generally first appear in greatest numbers along the edges of the foothills, which is their breeding-ground, in isolated swarms, often many miles apart. When first hatched, their powers of destruction are not great; but with each molt their voraciousness increases, and unless steps are promptly taken to combat them, or unless attacked by their natural enemies in numbers, cultivated crops in their path may be seriously injured or destroyed by them.

The grasshopper has many enemies. A Tachina fly, about the size of the common house fly, and which it much resembles, is one of the most abundant and most destructive to the hoppers. During the late outbreak of grasshoppers near Roseville, we are informed that great numbers of these flies might be seen in the air over the fields infested with grasshoppers, and when a grasshopper would rise from the ground a Tachina fly would immediately strike the grasshopper and deposit its egg, which would shortly hatch into a maggot and eat its way into the vital parts of the grasshopper, thus destroying it. When fully developed, the maggot enters the ground to pupate and soon emerges as a full-winged fly.

Mr. Compere, agent of this Board, while in New South Wales, in 1900, procured a few grasshoppers which had been parasitized by a dipterous fly, and although they were dead before being shipped, forwarded them to San Francisco to Alexander Craw, Quarantine Officer of this Board. A. M. Lea, Entomologist of Tasmania, informed Mr. Compere that he had found that 90 per cent of the female and 15 per cent of the male grasshoppers were parasitized by this fly. Mr. Craw placed the dead grasshoppers in a breeding-jar, and in a short time the parasites appeared. They were liberated in the Livermore Valley in 1900, the vineyards of which are often subject to the ravages of grasshoppers. It is probable that by this time they may have spread over the interior valleys of the State, and entered upon their career of parasitizing their hosts, which would account for the apparently sudden disappearance of the grasshoppers in many localities where they had been numerous and where fears of damage were entertained. It is to be hoped that this may prove true, and if so it will be another instance of the great value of the efforts of this Board in obtaining predaceous and parasitic insects to fight our injurious pests, such as the *Vedalia cardinalis*, which proved effective against the cottony-cushion scale, and the *Rhizobius ventralis* and *Scutellista cyanea*, effective against the black scale.

This fly (*Masicera pachytyli*, Sk.), which is represented in the accompanying cut, belongs to the order Diptera, the same as our common house fly, which it resembles. It has a bristly appearance and is formidable looking, because of the spines projecting in every direction. It is often found about flowers and green vegetation. The adult fly itself is of no economic importance, but the larvæ are parasitic, and in Australia have proved most efficient in lessening the number of grasshoppers. It is the natural enemy of the grasshopper, feeding most voraciously on the adipose tissues of its victim, but avoiding the vital parts. It feeds in the thorax and abdomen of the grasshopper, and frequently three or four may be found in a single grasshopper. A grasshopper infested by these maggots soon shows signs of feebleness, ceases feeding, and dies in a short time, the maggots escaping, often before the death of the grasshopper. The maggots, after extricating themselves from the grasshopper, enter the ground to pupate, and emerge in five or six days as perfect flies.

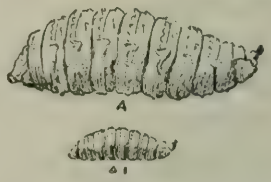


FIG. 4.

A. Larva of dipterous fly, parasitic on plague locust; magnified.
A 1. Same, natural size.

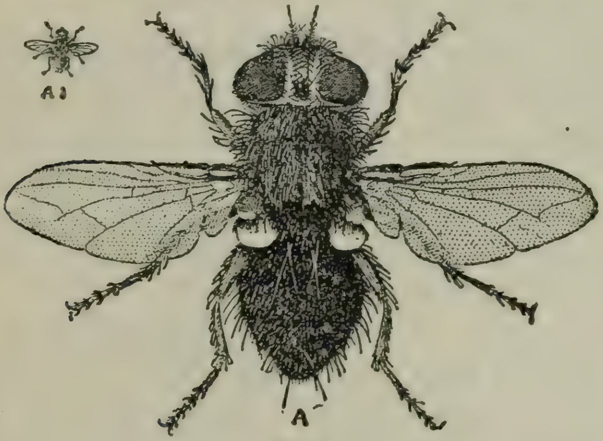


FIG. 3.

A. Tachina fly (*Masicera pachytyli*), a parasite of the plague locust; magnified.
A 1. Same, natural size.

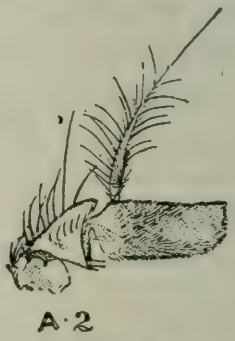


FIG. 5.

A 2. Antenna of *Masicera pachytyli*.

Birds also greatly aid in the destruction of grasshoppers. The common meadowlark is among the most active destroyers of this insect, and for this alone it is entitled to the protection of the law which it now enjoys. When grasshoppers are plentiful the meadowlark does not eat the entire insect, but only the abdomen or a portion of one, and this habit enables it to destroy a great number every day. Blackbirds of all varieties are also great aids in destroying them, but, unfortunately, the birds are breeding and taking care of their young when the grasshoppers first appear, and as their nesting-places are close to water in the tules and the breeding-grounds of the grasshoppers are near the foothills, perhaps miles away, their services are not near so valuable in proportion to their numbers as are those of the meadowlark, whose home may be in the midst of the young grasshoppers or adjacent thereto. Later in the season the blackbirds become fearfully destructive of grasshoppers. Woodpeckers also for a time cease their arboreal habits to prey upon the grasshoppers on the ground. While the sparrowhawks, owls, sparrows, ground larks, and in fact all land birds, except the dove, give their welcome aid in destroying the pests. It is said that skunks and gophers eat them, as do also toads, frogs, and snakes.

Grasshoppers, like all insects that gather in large swarms, are subject to contagious diseases, which rapidly spread and carry them off in large quantities, often almost exterminating them. The fungous disease is one of the most fatal to grasshoppers in some countries. Attempts have been made to introduce in this vicinity a South African fungus particularly fatal to grasshoppers, but we have not learned of the results and doubt that it will prove effective in California, because of our dry climate at the season of the year when the grasshoppers are most abundant, a moist climate being required for its successful propagation.

But when grasshoppers become numerous and destructive, it is not wise for farmers or horticulturists to await the action of natural causes, for proximity to cultivated areas does not give the necessary time for their action before great damage has been done. The farmer must, therefore, be prepared to defend his crop. As before stated, the best method to combat the pests is to plow the land known to contain eggs before the grasshoppers are hatched. Bulletin No. 55, of the Minnesota Agricultural Experiment Station, recommends plowing even after the grasshoppers have hatched and reached the surface, as follows: "In such case plowing should commence at the outer boundary of the grasshoppers, and a number of plows should be used at the same time, the plows following each other as closely as possible. The grasshoppers are in this manner forced to the center, where a black mass of struggling insects are crowded together. But few of them will escape, for as one plow makes a furrow, which is rapidly filled with grasshoppers, the following plow covers them up and most are buried alive, only a few near the edge escaping." After a few furrows have been plowed around the area infested by grasshoppers, it might be advisable to burn the grass on the inclosed ground to destroy the grasshoppers, for with this precaution the danger of fire getting beyond control would be reduced to a minimum.

The "hopper-dozers" have proved one of the most effective means of destroying grasshoppers. Their construction is simple, and any farmer can make them from the following description:

A piece of ordinary sheet-iron is turned up 1½ inches around the edges and riveted at the corners, which makes a shallow pan about 10 feet long, 2 feet broad, and 1½ inches deep. At the back of the pan is fastened a standard of light wooden frame, as long as the pan and about 2 feet high. Over this frame a canvas is stretched, for the purpose of throwing back any grasshoppers that otherwise would jump over the pan. On the bottom of the pan are riveted small strips, which can be fastened to three runners on which the pan rests and which are usually made from pieces of board with a curve in front to prevent them catching in the ground. The front ends of the runners are fastened to a cross piece, which is drawn by two ropes, one at each end. These ropes are fastened to a singletree. Two "hopper-dozers" are sometimes fastened to a long pole by short ropes, and they are easily drawn by one horse. Two can be used only on clean and level land. When the land is uneven only one can be used to advantage. In front of the pan is fastened a piece of rope or a small pole, which sweeps the ground, stirs up the grasshoppers, and makes them jump into the pan. In the pan is placed crude oil, or water, on which a pint of kerosene oil is thrown, and the canvas standard is also moistened with kerosene or crude oil. If water and coal oil are used, partitions should be placed in the pan to prevent the fluids from splashing out, or sacks may be thrown over the surface of oil and water. The machine is drawn on the fields where the hoppers are the thickest, and in a short time is partially filled with insects.

The effect of kerosene oil is so great that even the slightest touching of the canvas or the pan is certain death to the hoppers, for the oil will spread over their bodies, causing a paralysis, which is first shown by the stiffening of the legs. A large portion of the hoppers that fall into the pan will immediately hop out again, but they die in a very short time. It is estimated that only one out of every ten die in the pan, nine jumping out again. Kerosene also leaves a very strong odor which is disliked by the insects, and they stop feeding and move about in their efforts to escape it.

Poisoned baits are also very effective in the destruction of the hoppers where pans can not be used, as in vineyards and cultivated crops. The best is that recommended by this Board, which is as follows: Thoroughly mix 40 pounds of bran, 20 pounds of middlings, and 20 pounds of arsenic, adding two gallons of cheap molasses, and enough water to moisten the whole. This should not be scattered promiscuously over the ground, but a tablespoonful of the mixture should be placed on a shingle or shake, or on wooden plates such as are used by bakers under pies, the latter being very cheap. This will enable the poison to be removed when the danger is past, and not cause the death of stock, poultry, or the birds, which are the farmer's best friends. The receptacles containing the poison should be placed about eight feet apart, and if the hoppers are very numerous, a second row should be placed about ten feet distant from the first. The hoppers are very fond of this mixture and will greedily devour it. Should the mixture become hardened, it must be moistened to soften it.

Bulletin No. 25, of the U. S. Department of Agriculture, gives the following as the best means of protecting fruit and shade trees: "Where the trunks are smooth and perpendicular they may be protected by whitewashing. The lime crumbles under the feet of the insects as they attempt to climb and prevents their getting up, but they gradually wear off the lime and reach a higher point each day, so that the whitewashing must often be renewed. A strip of smooth, bright tin, three or four inches wide, answers even better for the purpose. The tin must be high enough from the ground to prevent the grasshoppers from jumping beyond it. Cotton batting, which encircles the tree, will entangle their legs, and forms a good obstruction. Strips of paper covered with tar; stiff paper tied on so as to slope, roof fashion; strips of glazed wall paper, and thick coatings of soft soap, have been used with varying success, but none equals the bright tin. A certain proportion of the insects, when they become fledged, will fly into the trees, and as they do most damage during the night, the trees should be unloaded before dark."

Smudging has also been used to ward off the winged swarms. Anything which produces a dense smoke will be effective, such as straw, coal tar, or crude oil. The use of smoke will be effective in proportion as farmers combine together and produce it simultaneously over large areas.

By using either the "hopper-dozers" or the poisoned bait, or both combined, it is possible for the farmer and horticulturist to protect his crops from any swarms of grasshoppers or locusts ever recorded in California. These are the plans recommended by the U. S. Department of Agriculture and by Agricultural Experiment Stations; and have been successfully tested in many States, after the pests have appeared. But the best and most thorough safeguard against this pest is the destruction of the eggs in the breeding-grounds.

PLANT LICE, OR APHIDS.

The plant lice, or aphids, are among the most numerous, both as regards species and individuals, of all known insects, and the destruction caused by them is commensurate with their numbers. There is scarcely a plant that is not attacked by them, and some plants, like the grape, peach, apple, cabbage, etc., have aphids peculiar to them.

They are all small, soft-bodied insects, with a body more or less pear-shaped, the winged forms having two pairs of delicate, transparent wings. The majority of plant lice are aërial in their habits, but some varieties also assume a subterranean form, and these are among the most destructive and widespread, the dreaded phylloxera and woolly aphis being the best known.

Their methods of reproduction are most unique and peculiar to themselves, and the different forms they assume—some winged and others wingless, some laying eggs, others bringing forth young alive and often without the intervention of the male, which in some forms has never been recognized—make them at once interesting and puzzling to the naturalist and entomologist.

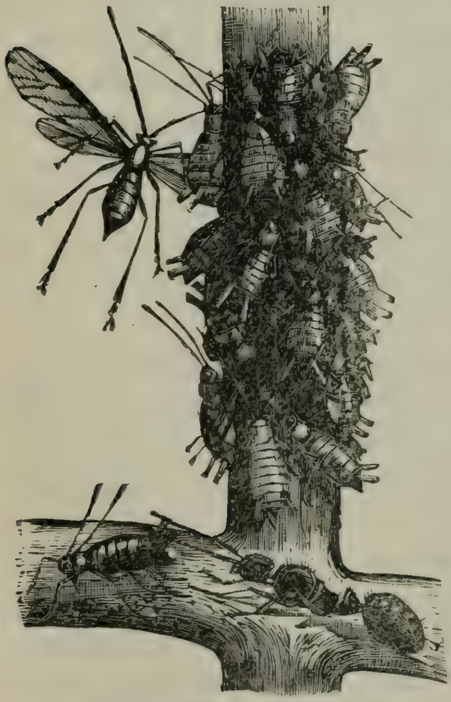


FIG. 1. Plant Lice and Ant.

In many varieties a sweet substance is produced, called honey-dew, which is exuded through two tubes situated on the back near the posterior part of the insect, which can readily be seen with the naked eye. This is the substance, when produced in large quantities, that drips from shade trees and spots the sidewalks beneath. This honey-dew is devoured by bees, wasps, and ants.

It is commonly believed that ants destroy plant lice; but the contrary is the fact. The ant treats and regards plant lice as milch cows. An ant will approach a plant louse, place its antennæ on its back, stroking it gently, when the louse will give forth its honey-dew, which the ant will immediately drink up. The ants take good care of their cows, and will transport them to new pastures when old ones fail, thus aiding greatly in their distribution. In fact, the remedy recommended for the corn-root louse is the destruction of ants' nests, the inmates of which mine along the roots of the corn, collect plant lice, and distribute them on the roots.

Plant lice obtain their sustenance by sucking the juices of plants which they infest, by inserting their proboscis in woody plants, in the tender terminal growths, peduncles of roses, etc., and in the succulent parts of plants and roots. While the amount taken by an individual is almost infinitesimal, their immense numbers often cause most serious injury to the plant they infest, and sometimes its destruction.

WOOLLY APHIS (*Schizoneura lanigera*).

Some plant lice, in addition to honey-dew, secrete a bluish-white, flocculent, cottony substance, which oftentimes almost completely conceals them, appearing to be tufts of cotton attached to leaves and twigs. The best known of the cotton-secreting species is the Woolly Aphis (*Schizoneura lanigera*), which has been distributed in every country where the apple is grown, and is one of the best known and most annoying pests of the fruit-grower. They can be seen infesting the branches and trunk of a tree, in which they form pits, the bark apparently ceasing to grow at the point of attack, but which swells into a ridge about the cluster of aphids. Those that appear above ground can be controlled without trouble, but the form which appears on the roots and produces gall-like swellings is much more difficult to extirpate. The injury to the tree is caused by the sucking of the sap, which deprives it of nourishment, and by the poisoning of the plants, shown by the galls on the roots.

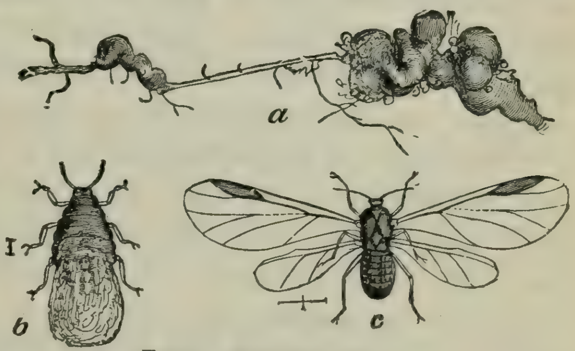


FIG. 2. Woolly Aphis.

Professor Marlatt, of the U. S. Department of Agriculture, says: "The damage is particularly serious in the case of nursery stock and young trees, and is less important after the tree has once become well established and of some size. Where this insect is abundant all the roots of a young tree, to the depth of a foot or so, become clubbed and knotted by the growth of hard fibrous enlargements, with the result in a year or two of the dying of the rootlets and their ultimate decomposition, with attendant disappearance of the galls and also of the lice, so that after this stage is reached the cause of the injury is often obscure. On the trunks the presence of the lice sometimes results in the roughening of the bark or a granulated condition, which is particularly noticeable about the collar and at the forks of branches, or on the fresh growth around the scars caused by pruning, which latter is a favorite location.

"On the water shoots they collect, particularly in the axils of the leaves, often eventually causing them to fall; and on the tender green side of the stems. The damage above ground, though commonly insignificant, is useful as an indication of the probable existence of the lice on the roots. A badly attacked tree assumes a sickly appearance and does not make satisfactory growth; the leaves become dull and yellowish; and even if not killed outright, is so weakened that it becomes especially subject to the attacks of borers and other insect enemies. Injuries from the woolly aphis are almost altogether confined to the apple, even the wild crab not being so liable to attack or at least injury by it. There is, however, some difference exhibited by different varieties of apple in immunity, and particularly is the Northern Spy proof against it; and it is possible that, as in the case of grape phylloxera, by employing root stocks from seedlings of the more resistant varieties or from wild crabs, considerable protection would result. The character of the soil also exerts some influence—that is, loose, dry soils are favorable, and wet, compact ones are unfavorable to the aphis.

"The common forms, both on the root and above ground, are wingless lice, not exceeding one tenth of an inch in length, of a reddish-brown color and abundantly covered, especially in the aërial form, with a flocculent waxy secretion. They are the so-called agamic females, and reproduce themselves by giving birth, as observed by many entomologists, to living young, indefinitely, perhaps for years, without the intervention of other forms. The newly-born larvæ have none of the white secretion, which, however, soon appears as a minute down when they begin to feed. These lice are also peculiar in lacking the honey-tubes common to most aphids, but exude the honey-dew from the tip of the body. In October or November, or earlier in the south among the wingless ones, numbers of winged individuals appear which are also females and the parents, as shown by the observations, partly unpublished, of Messrs. Howard and Pergande, of a true sexed generation of minute, wingless, larviform lice, the females of which, as in the case of the grape-root louse, give birth to a single 'winter egg.' This egg is attached within a crevice of the bark, and probably, following the analogy of the phylloxera, hatches in the spring into a female aphid which originates a new aërial colony.

"The winged females appear somewhat abundantly in autumn, and are one of the means of dispersal of the insect. They are very minute, clear-winged, gnat-like objects, greenish-brown, almost black in color, with the body covered with more or less of the cottony secretion.

"The aërial colonies are probably killed out every winter in the colder northern districts, but in the warmer latitudes the partly-grown individuals at least survive, protected in crevices or under bits of bark and remain more or less active during winter and renew the colonies the following spring. This has been shown to be true in the District of Columbia, and also in the interior regions of the same latitude, in spite of the much colder winters. The root form survives the winter usually in an immature condition, viz.: larvæ in various stages of development; and both in latitudes where the aërial forms are killed by the severity of the winter, and elsewhere, it seems probable that there is a regular upward migration in spring and early summer from the roots, the aërial colonies appearing first near the crown and at a later period on the higher parts of the tree. At any time during summer and fall there may be migrations to the roots, and throughout the year the subterranean colonies are maintained.

"The spread of the insect is accomplished in part by the viviparous females which appear in late summer, but quite as commonly perhaps by the transporting of young or partly grown individuals from tree to tree, or to distant orchards, by means of birds or insects to which they have attached themselves. Its wide distribution is usually dependent on the traffic in nursery stock."

Among the many remedies for the destruction of the woolly aphis, hot water has been generally recommended, but has been only partially successful. As much as possible of the surface soil should be removed, so as to facilitate wetting the roots. This remedy should be used while the trees are dormant.

The rosin solution, prepared according to the formula of this Board, for winter use upon deciduous trees for pernicious scales and lecaniums, has proved beneficial when applied by pouring it on the roots and swellings and by spraying on the trunks and infested limbs.

Finely ground tobacco, when applied at the rate of two to five pounds to the tree, has proved beneficial both by destroying the aphis and by acting as a repellant. From four to six inches of the soil should be removed for a distance of two feet from the trunk before applying the tobacco dust, afterward replacing the soil. The tobacco kills the aphids by leaching through the soil, and acts as a bar for a year or two to reinfestation. Tobacco is also a good fertilizer.

Bisulphide of carbon has also been used, but its use requires caution, or the tree may be killed. It should be applied in two or three holes around the tree to a depth of six or twelve inches, and not closer than eighteen inches to the trunk. The bisulphide penetrates throughout the soil and promptly kills the aphids.

Nursery stock, if not badly infested, can be cleansed by immersing in kerosene emulsion. Badly infested stock should be destroyed.

CABBAGE LOUSE (*Aphis brassicæ*).

This plant louse often occurs in immense numbers on the cabbage and allied plants, and is most destructive to the plants it infests. It appears every season, and unless measures are taken to destroy the lice, plants will become weak and fail to grow.

The wingless viviparous female is greenish-gray in color, with black spots on each side of the abdomen, usually obscured by a whitish secretion. The eyes and legs are black. The winged viviparous female is yellowish green, eyes black, the lobes of the thorax, honey tubes, and legs brown. The male has never been observed, nor is it known where the winter is passed.

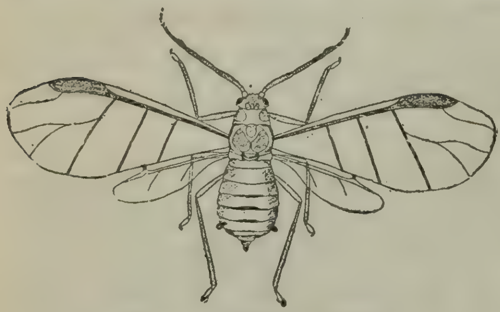


FIG. 3. Cabbage Aphis.

The exposed life of the cabbage lice makes them an easy prey to predaceous and parasitic insects, but sometimes they gather in such numbers that it is necessary to apply remedies to check their injuries. The ordinary whale-oil soap is a very effective remedy, and is prepared at the rate of one pound to eight gallons of water; kerosene emulsion is also recommended and is very penetrating. The plants should be thoroughly sprayed as soon as the lice appear, and the treatment should be repeated whenever necessary, as they are almost certain to reappear to some extent. Ground tobacco is also very satisfactory, as well as the tobacco decoction. To be effective, it is essential that the applications should be thorough. These poisons act by clogging the spiracles or by entering the body through them.

THE WHEAT APHIS (*Siphonophora avenæ*).

This louse in some years has caused great losses to grain-growers by sucking the sap from the leaves, stem, and young ears of grain, causing a decided shrinkage in the yield of wheat. Rye is also sometimes subject to its attacks. The winged insect is green, of various shades, with a large, oval spot on each side of the thorax and a row of dark-colored spots on each side of the abdomen. The wingless ones are more uniformly green in color.

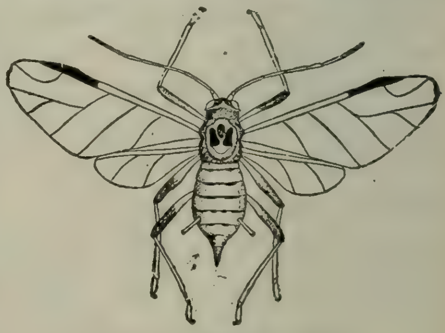


FIG. 4. Wheat Aphis.

It is difficult to apply any artificial remedy for these insects, on account of the extent of the fields and the vast quantity of insecticides that would be necessary to accomplish their destruction. Happliy they are subject to the attacks of numerous predaceous and parasitic insects, which prevent their numbers from becoming overwhelming. The causes which lead to their enormous increase in certain years are obscure and unknown, but mild winters are seemingly favorable for their propagation in the following spring.

The following description of its life history is given in Bulletin No. 72 of the New Jersey Agricultural Experiment Station:

"It has already been indicated that we do not know the full life history of this species and that we do not know the male. We know that it makes its appearance in winter wheat when it is out of the ground, flying from we know not where. The winged lice are few in number and they do not breed very fast. As winter approaches the lice crawl downward along the stem and get underground on the roots. These root forms are wingless, and they continue their work under the snow and wherever mild weather prevails, bringing forth young. With the approach of spring they crawl up the leaves and stalks, winged forms appear and they scatter, seeking fresh fields, where they multiply greatly. They disappear before the wheat is harvested, and what becomes of them at that time we do not know. There was never a male of this wheat louse known, and there was never any evidence that the species ever has a true egg."

THE HOP LOUSE (*Phorodon humuli*).

This insect is very destructive in the hop yards of Europe, the Atlantic States, and Oregon. In the latter State it is estimated that the loss from this source amounts to fully one twelfth of the crop. It has been reported that it has made its appearance in this State in some of the numerous hop yards, but as it closely resembles some of the other species a mistake may have been made in its identification.

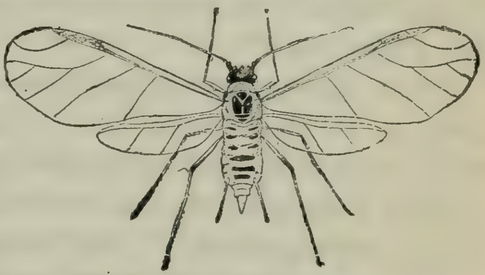


FIG. 5. Hop Aphis (winged).

The life history of this aphid has been closely investigated by patient observers. Professor C. V. Riley gives the following as its life history: "Wherever it occurs, whether in England or on the continent of Europe, in New York, Wisconsin, or on the Pacific Coast, the hop-plant louse has substantially the same life round. The eggs are laid in the fall on different varieties and species of the plum, both wild and cultivated. They are small, glossy, black, ovoid, and are attached to the terminal twigs, especially in the more or less protected crevices around the buds. From this egg there hatches in the spring, about the time when the plum buds begin to burst, a stout female plant louse, known as the stem mother, which differs from the summer individuals by having shorter legs and shorter honey tubes. She give.

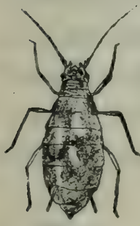


FIG. 6. Hop Aphis (wingless).

birth, without the intervention of the male, to living young, and this method of propagation continues until the last generation of the season. The second generation grows to full size and gives birth to a third, which becomes winged and develops after the hops have made considerable growth in the yards. The winged lice then fly from the plums to the hops, deserting the plum trees entirely and settling upon the leaves of the hops, where they begin giving birth to another generation of wingless individuals. These multiply with astonishing rapidity for from five to twelve generations, carrying us in point of time to the hop-picking season. (Each female is capable of producing on an average about one hundred young, at the rate of three per day under favorable conditions. Each generation begins to breed about the eighth day after birth, so that the issue from a single individual runs up, in the course of a summer, to trillions. The issue from a single stem-mother may thus, under favorable conditions, blight hundreds of acres in the course of two or three months.) There then develops a generation of winged females, which fly back to the plum tree and give birth to the true sexual females, which never acquire wings and never leave the plum tree. By the time this generation has matured, which involves but a few days, varying according to the temperature, belated winged individuals, which are the true males, fly in from the hop fields. These fertilize the wingless true females upon the plum leaves, and these soon after lay the winter eggs. Thus there is but one generation of sexed individuals produced, and this at the close of the life round—the females, wingless, on plum trees; the males, winged, on hops. All intervening generations are composed of virgin females only (parthenogenetic). This is the invariable round of the insect's life."

From the foregoing life history the two most vulnerable points to attempt its destruction are, in the spring while it is yet on the plum trees, and in the fall before the male leaves the hop yards. Plum trees should be sprayed to kill the lice before they migrate to the hop yards in the spring, and all hop vines should be burned or drenched with kerosene as soon as the hops are removed, in order to destroy the male, which does not leave the hop yards until some time after the hops are picked. Hop-growers should, if possible, not permit any wild or cultivated plum trees to grow near their hop yards. As insecticides, kerosene emulsion and whale-oil soap may be used. The following is the formula for the spray used in Oregon: Quassia chips, 8 pounds; whale-oil soap, 6 pounds; water, 100 gallons. The quassia chips should be fresh and the whale-oil soap not less than eight per cent strength. Spray as soon as the aphis appear, and continue as long as practicable.

BLACK APHIS OF THE PEACH (*Aphis persica-niger*).

This aphis has proved very destructive to the peach trees of the States on the Atlantic seaboard, and as it exists in two forms—aërial and subterranean, similar to the woolly aphis—its control is subject to all the perplexities of the latter aphis. It attacks the leaf buds when they are pushing in the spring, and so numerous do they become that they frequently kill young trees and seriously damage large branches on older trees. The following is the description of this aphis by Alexander Craw, Quarantine Officer and Entomologist of this Board:

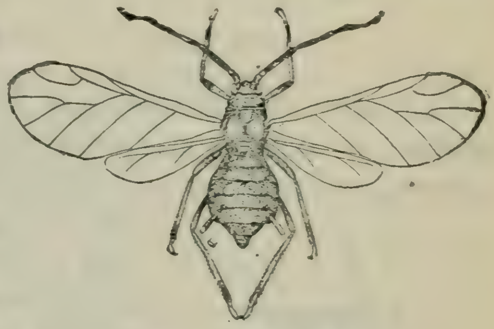


FIG. 7. Peach Aphis.

"It is of a shining black or very dark brown color. The legs are deep brown on the thighs, the tips of the shanks and the tarsi; elsewhere yellowish. The cornicles or honey tubes are quite long, moderately slender and of the same color as the body. There is a series of deep pits on each side of the abdomen.

"The wingless form differs in the somewhat stouter body, but is very generally like the winged type in color and general structure. The young are of a faint greenish brown, becoming darker as they grow older, until they are of the typical shining black peculiar to the full-grown specimens. The antennæ of the winged form have the sensory pit extremely developed, every joint beyond the basal knob joints being furnished with them. In the wingless form the antennæ have only the usual single pit on the third long joint and the little group on the whip joint.

"Its life history is as follows: This species is found on the roots of the trees throughout the year and it breeds there quite undisturbed. Early in spring, or when the leaf-shoots begin to start, it makes its way to the surface and to the branches. Here the winged form develops and then makes its way to new quarters, founding new colonies wherever it reaches, and these about midsummer make their way to the ground and to the roots. Usually some few specimens are to be found on the leaves throughout the summer, but they are much more abundant in the spring. No males of this species have been observed, and no eggs have been found."

When trees are badly attacked by this aphis the leaves are yellowish, more or less curled, and spotted with fungus. Bulletin No. 48, of the Maryland Agricultural Station, recommends: "Where the insect is found on old trees it is best to cut out the infested twigs and burn them. It is readily killed with kerosene emulsion or whale-oil soap, but it must be borne in mind that the black or brownish lice are more resistant to the sprays than the green species. The sprays must therefore be used in stronger solution. Kerosene emulsion diluted ten or twelve times with water and one pound of whale-oil soap in six gallons of water would serve to accomplish the result. When the pest gains a foothold in a nursery, the most satisfactory method is to dig up the stock and burn it."

THE PLUM AND CHERRY APHIS (*Myzus cerasi*).

This aphis closely resembles the peach aphis in general coloring and shape. It appears as soon as the leaves of the trees on which it feeds expand, and multiplies very rapidly, being hatched from eggs deposited on the branches the previous fall. They are not so abundant in midsummer, but become numerous again in the autumn, when the sexes appear and the eggs are laid at the base of the buds and in cracks of the bark, where they remain during the winter and hatch the following spring. They sometimes crowd together in such dense masses that they stand two deep, with just sufficient space between them to enable each individual to insert its beak into the leaf, and before long they completely cover the leaf-stalks, stems, and green berries. They secrete a large amount of honey-dew, which attracts numerous flies, etc. They are subject to the attacks of many lice-destroying insects, which cause immense destruction among them, the trees being nearly cleared of them, but they reappear again later in the season on the terminal leaves. The remedies applied for other species of aphids will be found effective against this one.

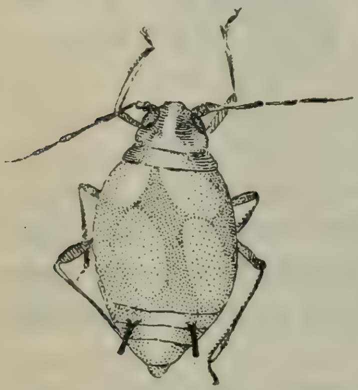


FIG. 8. Plum Aphis.

There are many other species of aphis affecting gardens. Rose bushes are often attacked by a green species, which literally covers the young growth of stems at the ends of branches and the peduncles of the buds, giving the plants a disgusting appearance and injuring them by withdrawing the sap and spoiling the flowers. They may be destroyed by the use of kerosene emulsion, whale-oil soap water, or a decoction of tobacco. These, however, will injure the appearance of the plants. An equally effective means is to remove them by playing a strong stream of water from the garden hose on the infested portions of the plants, which washes the lice from the bushes. If they are knocked from the plants while the beak is inserted in it, and the smallest portion of the tip is broken off, it will prevent them from feeding and necessarily prove fatal to them.

Chrysanthemums are also attacked in the early summer by a species of black aphis, which crowd in immense swarms on the stalks and leaves, greatly to the injury of the plants. Carnations are also subject to the attacks of aphis, which, with the rust which also appears in the summer time, so injures the plants as to prevent the proper development of the flowers. These can be removed or destroyed by the remedies recommended for other species of lice.

Plant lice have many natural enemies which aid greatly in keeping them in check. In fact, without their aid all the efforts of man to prevent the destruction of his plants would prove unavailing. Among the most active in this warfare are the parasitic flies, which are mostly very small and with four transparent wings. They lay a single egg on a louse, which hatches and produces a maggot in the interior of the host, and which feeds on the juices of the louse until it changes to a pupa, from which it emerges through a small hole cut in the body of the louse. A close inspection of a family of plant lice will disclose many with this hole in them. A parasitized louse may be told, even before its death, by the swollen abdomen, which will distinguish it from its non-parasitized mates.

One of the most numerous of the predaceous insects is the Syrphus, or flower flies, which may be seen hovering around flowers, remaining for a short time stationary in the air. They bear some resemblance to a yellow-jacket, with broad yellow bands across the abdomen. They are called "angels" by some children. The fly in its mature state is of no economic importance. The larvæ, however, are very destructive of plant lice. The parent fly lays a single egg among a family of lice, which hatches in a few days and immediately commences its work of destruction. It seizes a louse, and holding it aloft while it kicks and struggles, sucks the juices from its body and then casts the empty skin away. These maggots are blind and have no distinct feet, but they have no trouble in finding a louse by extending the segments of the body, which enable them to nearly double their length, and to strike here and there until they find their prey.

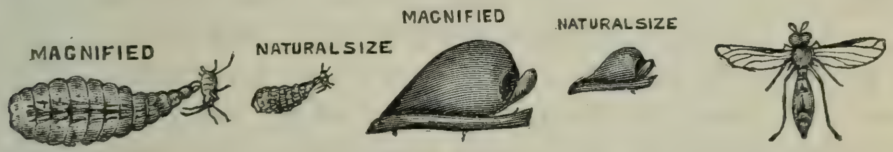


Fig. 9. Syrphus Fly—Pupa and Larva.

The "lady-bugs," or "lady-birds," are also important factors in the destruction of aphis, both as adults and larvæ; but as they consume the entire louse they can not compare with the larvæ of the Syrphus flies in the speedy disposal of aphis. By actual observation a Syrphus fly larva disposed of five lice while the larva of a lady-bug was consuming one. The young of the lady-bird resemble minute alligators in appearance, and are brightly colored and very active in searching for colonies of lice. The mature lady-bird also devours great quantities of lice, but is not as voracious as the larva. The larvæ, when fully grown, coil up into little balls, attaching themselves to a leaf or other convenient place, change to pupæ, and in about eight or ten days to beetles. These live during the winter in crevices of trees or boards or wherever they can find shelter; they emerge in the spring and lay eggs, generally on leaves, the yellow egg, a long oval, standing on end in groups of about twenty, which hatches in about ten days if the weather is warm and favorable. It would be wise for the farmers and horticulturists to provide harbors of refuge for lady-birds during the winter, in order that the greatest number may survive and be ready to attack the aphis while they are few in numbers, and not be compelled to await the hatching of a second brood of beetles before their numbers become sufficiently great to check the aphis, which increase too rapidly for the few over-wintering lady-birds. This shelter could be easily and effectively provided by placing or nailing inverted corn husks in trees and plants, in the protection of which the lady-birds could safely pass the winter protected against cold and rain by the husks, which would readily shed the water.

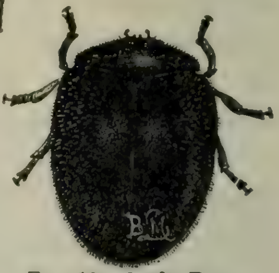


FIG. 10. Lady-Bug.

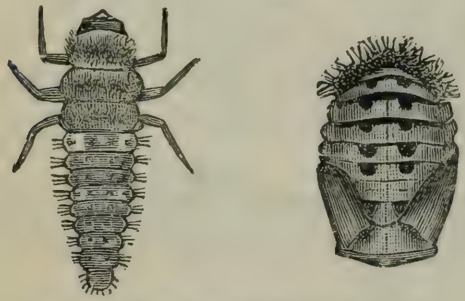


FIG. 11. Lady-Bug—Pupa and Larva.

The "lace-wing flies," or "golden-eyed flies" (*Chrysopa californica*), as they are often called, lend great assistance to the farmers by destroying, in immense numbers, aphids of all varieties. They are the most efficient, according to number, of all the predaceous insects. In the adult stage, they feed very little, or not at all. They are beautiful but fragile-looking insects, of a pale green color, the wings being finely reticulated, with long antennæ and prominent bright, yellowish-brown eyes. When handled they are easily crushed, and emit a peculiar, sickening odor. The larvæ will readily attack any insect which they can overcome, even becoming cannibals when two chance to meet, and are considered injurious in some parts of this State, because they attack and devour the larvæ of lady-birds.

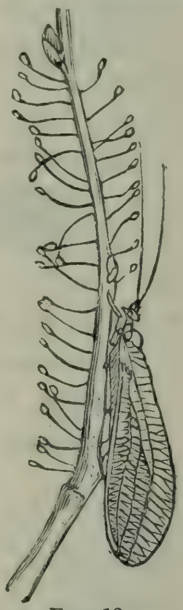


FIG. 12. Lace-Wing Fly, at rest, and eggs.

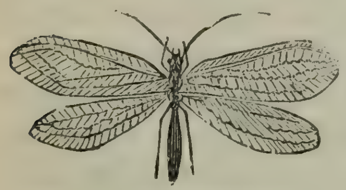


FIG. 13. Lace-Wing Fly, wings expanded.

The following interesting life history is given in Smith's Economic Entomology: "The female in ovipositing touches the end of the abdomen to the surface—usually a leaf—upon which the eggs are to be laid, and elevates her body about a quarter of an inch, emitting at the same time a viscid thread, which hardens on exposure to the air. At the tip of this the egg is fastened, and we thus get a little grove of eggs on stilts. This is supposed to protect them from wandering, predaceous forms that might otherwise feed upon them. When the larva hatches it climbs down the slender thread and attacks and feeds upon the first suitable specimen it can find, usually a young plant louse. Now there is another peculiarity: it does not chew or tear its prey, but holds it firmly, sucking the juices by means of grooves on the inner side of the large mandibles, which are closed by the slender maxillæ. The larva grows rapidly, becoming rather more than a quarter of an inch in length, narrow, spindle-shaped, pointed at the anal extremity, the head distinct and with prominent sickle-shaped mandibles. When full grown it spins, by means of anal glands, a perfectly spherical, white silken cocoon of very dense texture and small in proportion to the larva. It resembles a moderate sized pearl in form and appearance, and when the adult is ready to emerge a circular lid is lifted off to give the matured pupa exit. Comparing the fully developed insect with the cocoon from which it issued, the marvel is great that it was ever packed away in so small a space."

The phylloxera, so destructive to grapevines, belongs to the family of plant lice, but it has been so often described that we will not attempt to repeat it.

THE ARMY-WORM.

(*Leucania unipuncta.*)

Complaints reached this office, in the later spring and early summer months, of depredations done by army-worms, several swarms of which had appeared and in unusually large numbers. One of these swarms was especially bad in Tulare County, and in writing of them, Mr. P. J. S. Montgomery, manager of the Paige orchard and vineyard, states that "they did much damage before we were able to get entirely rid of them, denuding the vines of all foliage, leaving the first crop exposed to the sun, which naturally blistered and was lost. We made a hard fight, however, and exterminated them entirely with the loss of crop on about twenty acres of vines. We used a strong Paris green spray, which was in a measure effective. Those not killed by the spray were destroyed by hand labor, using a gang of men to level the earth carefully, dissolving all clods, making the ground perfectly level, then shaking the worms off and killing them with paddles. Only a light shake was necessary to throw them from the vines. Had we not adopted this plan our entire vineyard might have been badly damaged."

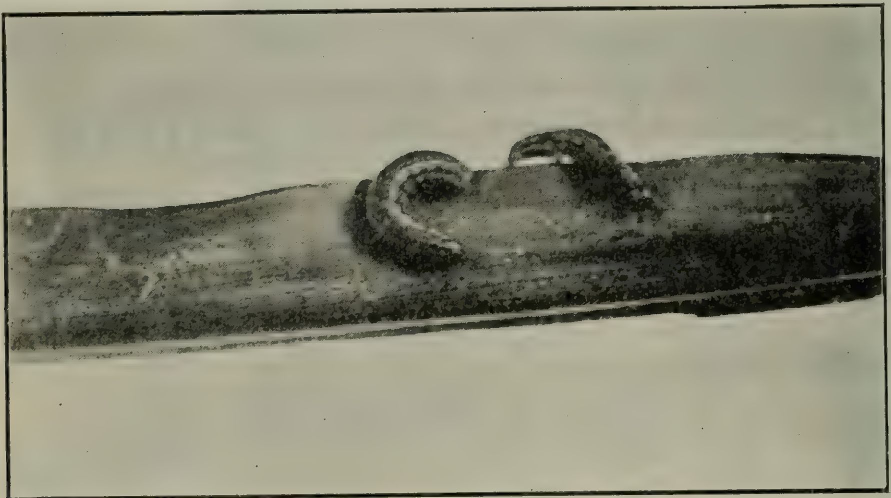


FIG. 1. Two Army-Worms. (From photograph by New York Experiment Station.)

Fortunately such outbreaks are not of frequent occurrence and never appear for two consecutive seasons in the same locality. As occasional outbreaks have occurred many times in the past and in different parts of the State, a sketch of the life and habits of the army-worm will, therefore, be of value to our fruit-growers and farmers. The bands so far reported in our State are comparatively small and usually confined to a few acres in extent, while in the East the swarms sometimes cover many miles. The moth which produces them is a night-flier, and the caterpillars burrow under the ground during the daytime. So they may exist by millions in a small area and their presence escape notice until, having exhausted the food-supply of their breeding-grounds, they take up the line of march for new pastures.

The following extracts are from a bulletin by Clarence M. Weed, published by the New Hampshire Experiment Station, and the illustrations by M. V. Slingerland in Cornell University Bulletin No. 133:

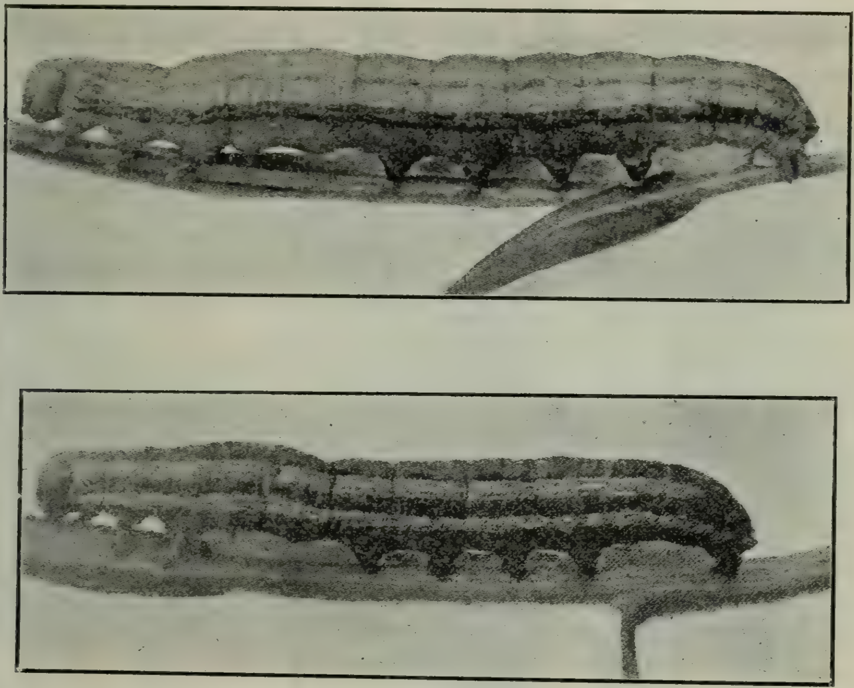


FIG. 2. Light and Dark Varieties of the Army-Worm; greatly enlarged.

"*The Life of the Army-Worm.*—The story of the life of the individual army-worm may be briefly told. On some summer night there appears in the meadow a good-sized, light-brown moth. Flying about she finds a cluster of strong-growing grass. Into the folded leaves of one or more of these she pushes a number of small whitish eggs, gluing them in rows of a dozen or more. A week or ten days later each egg hatches into a minute, whitish worm, that nibbles at the grass blades at night and in the daytime hides beneath the grass from the rays of the sweltering sun. It grows rapidly in size. At the end of a week it molts or casts its skin, a process in which the old skin splits open along the back and the worm crawls out, clothed in a new skin that had developed beneath the old one. Again it feeds as before, its voracity increasing with its size. This molting is repeated four or five times during the month after the worms hatch, so that by the end of this period the insect is an inch and a half long, and has the familiar markings of the full-grown army-worm.

"The instinct of the worm now teaches it to seek more secure shelter for the helpless stage upon which it is about to enter. It burrows into the soil an inch or less and wriggles about in the earth until it produces a hollow cell. In this it casts its skin again and becomes a pupa—the third stage of its existence. When the worms are very abundant, many of them do not go into the ground, but change to pupæ beneath whatever shelter may be at hand. About a fortnight later, another change takes place, and the fully-developed moth emerges from the pupa, thus completing the round of the insect's life. The moths fly toward dusk and at night, and by means of their long tongues, coiled up when not in use, they suck the nectar of various flowers.

"The moths sometimes seem attracted by buildings. I have been told of their swarming toward the close of cloudy afternoons about barns and outbuildings.

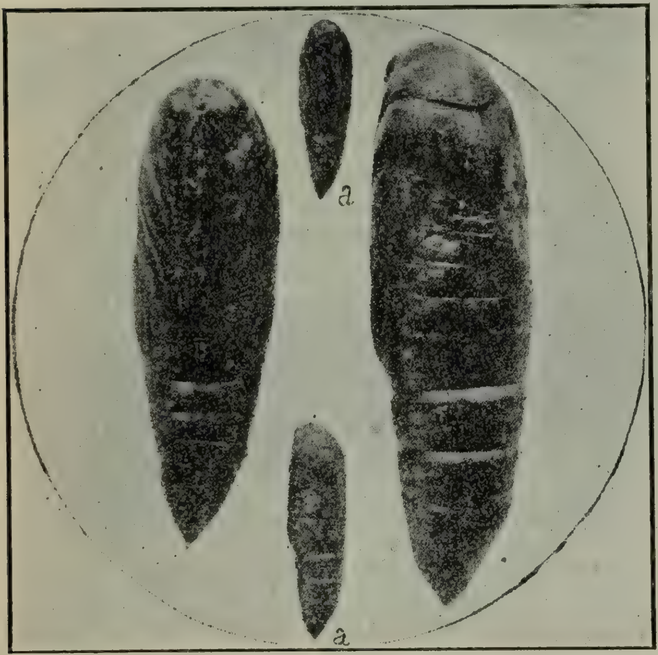


FIG. 3. Pupa into which the army-worm transforms; natural size at *a*.

"*The Army Habit.*—During ordinary years the army-worm is present in most of the regions where its outbreaks occur, individual worms feeding here and there in meadows and pasture lands, but the number is not sufficient to attract notice. At such times their habits of life are very similar to those of the common cutworms, to which, indeed, the army-worms are closely related. It is only when these insects become so excessively numerous that they exhaust the food-supply of the field in which they develop, that the 'army' habit is assumed. Then, however, they are forced to seek new quarters for food, and as their only mode of progress is by crawling along the ground, they move in solid masses toward adjacent fields. 'Their numbers at these times,' wrote Dr. C. V. Riley, 'are often so enormous, and their voracity so great, that it is impossible for one who has not been an eyewitness to appreciate it fully. * * * The army-worm when traveling will scarcely turn aside for anything but water, and even shallow watercourses will not always check its progress, for the advance columns will often continue to rush headlong into the water until they have sufficiently choked it up with their dead and dying bodies to enable the rear guard to cross safely over. I have noticed that after crossing a bare field or road where they are subjected to the sun's rays, they would congregate in immense numbers under the first shade they reached. In one instance I recollect their collecting and covering the ground five or six deep all along the shady side of a fence for about a mile, while scarcely one was seen to cross on the sunny side of the same fence.' This avoidance of the sunshine must have been noticed by every observer of army-worm outbreaks. On damp, cloudy days one may find numbers of them feeding near the top of grass and grain stalks, but on hot, sunny days few, if any, are to be found in such situations. They then occur in the shaded rubbish at the soil surface.

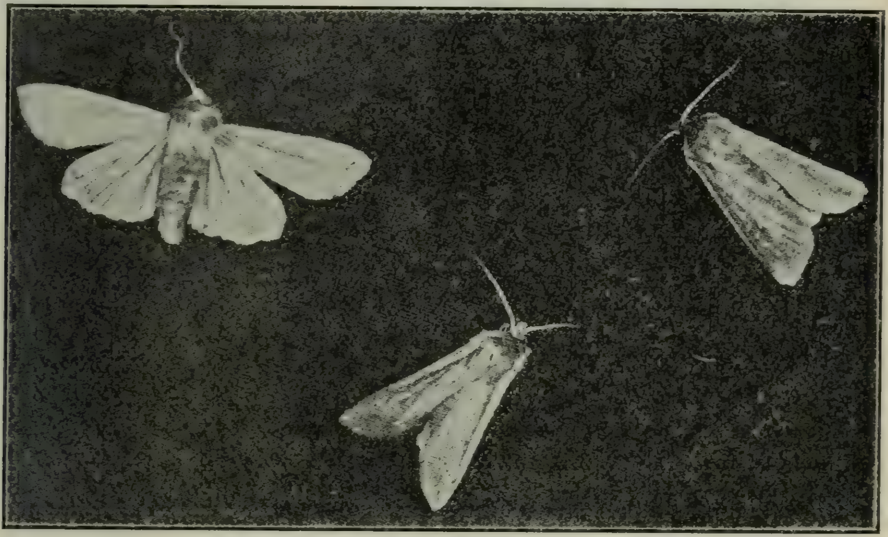


FIG. 4. Moths of Army-Worms; natural size.

"*The Choice of Food.*—The army-worm feeds by preference upon plants of the great grass family, which includes both the grasses and grains. The moths are especially attracted, for the deposit of their eggs, to rank growths of grass-like plants. In feeding upon timothy and similar grasses the leaves are first stripped, and in cases of severe attacks the heads will be wholly or partially gnawed off. They also feed freely upon the leaves and more or less upon the succulent stalks of wheat, oats, barley, rye, sorghum, and Indian corn. Generally they feed upon clover only when driven to it by hunger.

"*The Life-stages of the Insect Described.*—The egg of the army-worm moth is a tiny whitish sphere with a diameter of only about one fiftieth of an inch. When first deposited it is dull and opaque, but soon afterward it becomes shiny and more or less iridescent. Just before hatching it appears much darker. The spherical outline in many specimens is changed by the sticky material attached to them at the time the eggs are deposited.

"The larva when full-grown is of the form represented in Fig. 5, *c*. It is a smooth, cutworm-like caterpillar, an inch and a half long, generally of a dark gray or dingy black color, 'with three narrow yellowish stripes above, and a broader one or slightly darker on each side, thinly clothed with short hairs (to be seen with a lens), which are longer and somewhat thicker on and about the head. The latter is of a polished honey-yellow color, with a network of fine dark brown lines and a black line on the front, like the letter V reversed.' The size of the mature worm varies considerably, some specimens reaching a length of two inches.

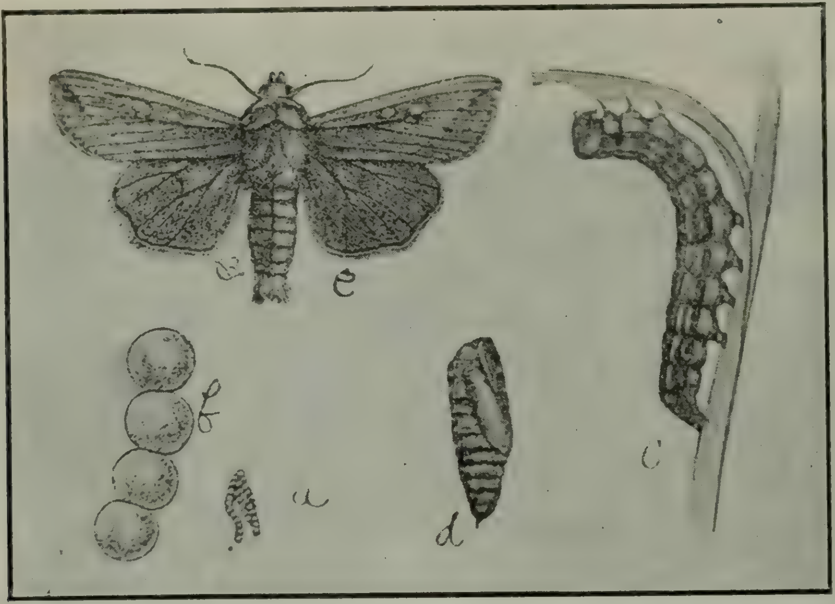


FIG. 5. THE ARMY-WORM. (After Riley.)

(*a*) Egg-mass, natural size; (*b*) Eggs, magnified; (*c*) Full-grown larva; (*d*) Pupa; (*e*) Moth.

"The pupa into which the full-grown army-worm changes before it can become a moth is represented in Fig. 5, *d*. It is a quiet, footless, wingless object, of a bright mahogany-brown color, and measures about three fourths of an inch in length. At the smaller end there are two pointed projections side by side, and near the base of each projection is a smaller, more slender spine with a hooked tip.

"The adult moth into which the army-worm develops, and from the eggs of which it originates, is represented, natural size, in Figs. 4 and 5, *e*. Its expanded wings measure about an inch and a half from tip to tip, although there is considerable variation in the size of different specimens. The general color of the body and front wings is a peculiar reddish-gray, perhaps more distinctly described as fawn color. Near the middle of each front wing are two more or less irregular lighter patches, each of which on closer study is seen to be made up of three smaller spots. Along the side margins of both pairs of wings there is a fringe of feathery scales, immediately inside of which, on each of the front wings, is a row of blackish dots. The hind wings are more grayish, with less of the reddish tinge.

"*The Army-Worm's Enemies.*—Fortunately for the American farmer, the army-worm has a host of natural enemies, which generally keep it below the danger line. A large number of birds consider the juicy worms excellent eating, and feed freely upon them. A list of such birds would include nearly all of our native insectivorous species that search for food upon the ground, but special mention should be made of the robin, the blackbird, the bobolink, and the meadowlark, which search grass-lands for insect larvæ more persistently than many other of our common birds. These and other birds are very useful in keeping army-worms and cutworms in check, and should be encouraged by every one.

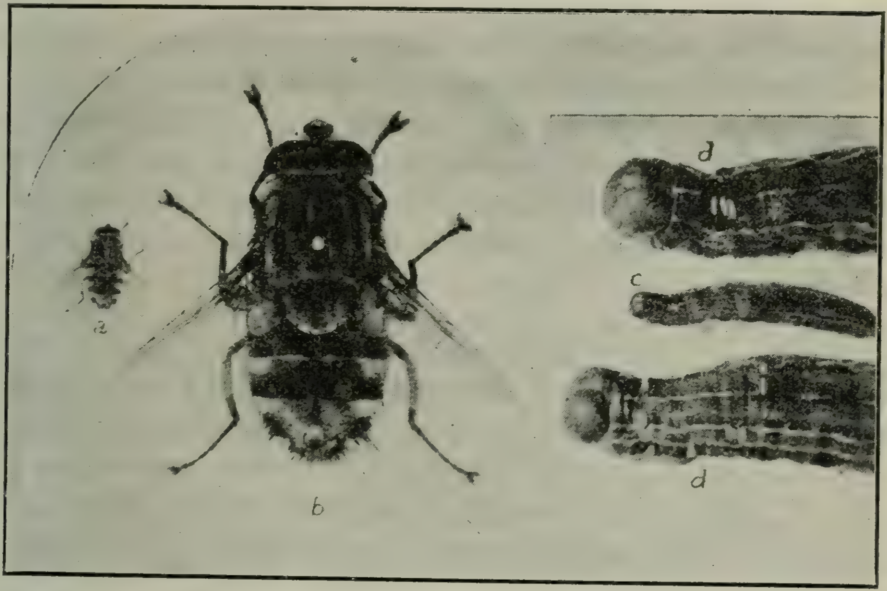


FIG. 6. THE RED-TAILED TACHINA FLY (*Winthemia 4-pustulata*).
(*a*) Fly, natural size; (*b*) Fly, much enlarged; (*c*) Army-worm upon which the fly has laid eggs, natural size; (*d*) Parasitized army-worms, enlarged.

"But the birds are not the only enemies of the army-worm. In the fields where the pest has been present this season there have also been found a great many large black beetles. During July I examined a barley field in which the grain had recently been cut and placed in piles, beneath which the army-worms had congregated in great numbers. There were also present beneath each pile about a dozen of these black beetles, devouring the helpless worms. These predaceous beetles are commonly called ground beetles, because of their habit of living upon the ground, but sometimes they are also called caterpillar hunters.

"There are also many species of internal parasites that prey upon the army-worms. Among the most abundant of these are certain two-winged flies that glue eggs upon the backs of the worms. The eggs hatch into tiny footless maggots, that enter the bodies of the worms when they hatch, and develop inside at the expense of their unwilling hosts. Finally they kill the worms and the maggots change to pupæ, from which they soon emerge as flies. These are called Tachina flies.

"There are several species of four-winged Ichneumon flies that have a similar history, and are often very destructive to the hosts of army-worms.

"The larger ground spiders also feed freely upon these worms; and the moths are often entrapped in the webs of the spinning spiders.

"More fateful and insidious even than these other enemies, are the microscopic germs of a bacterial disease—a sort of insect cholera—that often attacks the army-worm when it becomes over-abundant, reducing quickly its invading ranks to below the normal level.

"To the action of these various natural checks is doubtless due the seemingly strange appearance and disappearance of this vexatious pest. Nature strives ever to keep a balance in her affairs, and when an insect becomes too abundant, she marshals her various forces to bring it into subjection.

"*Remedial and Preventive Measures.*—When an outbreak of army-worms is first noticed, if it is confined to a limited area it is generally well worth while to cut down the grass or grain infested. The worms will remain beneath its shelter for two or three days, and as soon as the cut grass or grain is dry enough it should be burned, thus destroying the pests and preventing the invasion of neighboring fields. The worms may also be destroyed by spraying them with strong kerosene emulsion. This is prepared by adding two gallons of kerosene to one gallon of a solution made by dissolving one half pound of hard soap in one gallon of boiling water, and churning the mixture by forcing it back into the same vessel through a force-pump with a rather small nozzle, until the whole forms a creamy mass, which will thicken into a jelly-like substance on cooling. The soap solution should be hot when the kerosene is added, but of course must not be near a fire. The emulsion thus made is to be diluted, before using against the army-worm, with five or six parts of water to one part of emulsion. The amount of dilution varies with different insects. Soft water or rain water should be used in diluting. If this can not be obtained add a little lye or bicarbonate of soda. It should be applied with a spray pump or nozzle.

"The device of stopping the armies of traveling worms by means of ditches and trenches occurred to the earliest sufferers from their depredations. In the New Hampshire outbreak of 1770, Mr. Powers tells us that the inhabitants 'dug trenches around their fields a foot and a half deep, hoping this might prove a defense; but they soon filled the ditch, and the millions that were in the rear went over on the backs of their fellows in the trench and took possession of the interdicted food. The inhabitants then adopted another expedient to save those fields yet standing. They cut a trench as before; then took round and smooth sapling sticks, of six or eight inches diameter and six or eight feet in length, sharpened them to a point, and with these made holes in the bottom of the ditch, once in two or three feet; and as their meadows were bottom lands, they experienced no difficulty in extending these holes to two or three feet in depth below the bottom of the trench. The sides of these holes were made smooth by the bar or lever which made the holes, and as soon as the worm stepped from the precipice he ended at the bottom, and could not ascend again; indeed, he was soon buried by his unfortunate fellows who succeeded him in his downfall. Now those who made these holes to entrap their invaders went around their fields and plunged these pointed levers into the holes filled with worms, and destroyed every one of them at a single thrust.' Similar methods of fencing off the worms have often been employed to good advantage since. The side of the furrow or trench next the field to be protected should incline obliquely so that the upper part will be nearer the side toward the worms than the lower part, thus rendering its ascent more difficult. In cases where holes are not dug in the bottom of the trench to trap the worms, they may be killed by dragging boards or small logs along, or by strewing the trench with straw from time to time and then burning it.

"Some years ago Dr. C. V. Riley wrote: 'From experiments which I have made, I am satisfied that where fence lumber can be easily obtained it may be used to advantage as a substitute for the ditch or trench by being secured on edge and then smeared with kerosene or coal tar (the latter being more particularly useful) along the upper edge. By means of laths and a few nails the boards may be so secured that they will slightly slope away from the field to be protected. Such a barrier will prove effectual where the worms are not too persistent or numerous. When they are excessively abundant they will need to be watched and occasionally dosed with kerosene to prevent their piling up even with the top of the board and thus bridging the barrier. The lumber is not injured for other purposes subsequently.'

"One of the simplest ways of preventing injury by the army-worm, where it can be done without danger to livestock, is that of dusting or spraying with poison a strip of grass or grain in advance of invaders. The simplest way of doing this would be to apply Paris green, when the dew is on in the morning, by means of one of the insecticide bellows now upon the market, designed more especially for use against the potato beetle. The poison can be applied to a strip of grass by the spray-pump or nozzle, or even from a watering-pot, but this is an unsatisfactory way, because the grass-blades do not hold the spray. It would probably be better to dust the poison from a bag on the end of a pole. Cattle should not be allowed in the field so treated until there has been plenty of time for the rains to wash the poison into the soil.

"There is probably no general method that can be used more effectively for destroying army-worms than that of burning-over, in autumn or early spring, grasslands in which the worms are present. As already indicated, a portion of the pests appear to go through the winter as partly-grown worms. Consequently it seems well worth while to examine carefully fields in which they are likely to be present, and burn them over as thoroughly as is possible. Where it can easily be done, this burning is also advisable as a preventive measure, even in regions where the worm has not been destructive this year. The burning should also include old rubbish heaps and such worthless miscellaneous materials as may serve as a hiding-place for this and other injurious insects, either in the larval or moth stages."

THE CANKER-WORM.

(*Paleacrita vernata*, Riley. *Alsophila pometaria.*)

This insect has been reported from several parts of the State during the summer, but not in great quantities, nor has it done serious damage. The most serious reports come from the Pajaro Valley, and, writing from there, Mr. C. H. Rodgers says: "In regard to the damage done by the 'measuring-worm' in this section this season, will say that there was no material loss to the orchardist on account of this pest. As yet it is confined to a few small areas scattered here and there through the valley. It seems to thrive only on heavy loam or adobe soils, and is rarely seen on trees growing on sandy soil. The egg-laying season here does not correspond with the time as laid down in Bulletin No. 71, page 11. This bulletin states that the eggs are laid during November and December throughout California, and I have watched the progress of egg-laying very carefully during the past winter and spring. The first canker-worm eggs I discovered on January 28th. In February I found a few, but most of the eggs were deposited during the month of March, and the great majority were deposited during the last part of the month. Many eggs were deposited in the early part of April. I found freshly-deposited eggs up to April 10th. I am not mistaken in the assertions I make, because I had certain trees in my own orchard under observation and studied the matter closely. The remedy which gave best satisfaction here was 'banding' the tree with heavy paper, smearing the paper with equal parts of coal tar and molasses, and shaking the insects off the tree. In attempting to crawl up the tree the insects became entangled in the sticky material and perished. Paris green, 1 pound to 200 gallons, did not have the desired effect. Wire netting, as recommended in Bulletin No. 71, has not been tried, but I propose to adopt this plan this coming season."

As there are two forms of canker-worm, which resemble each other very strongly in their markings and habits—the spring canker-worm (*Paleacrita vernata*, Riley) and the fall canker-worm (*Alsophila pometaria*)—our correspondent, while correct in his observations, may not be correct in all his conclusions.

The canker-worms belong to the order Lepidoptera, super-family Geometrina, and are commonly known as measuring-worms, loopers, or, as sometimes called, inch-worms, from their peculiar way of walking.

They sometimes appear in very large numbers in secluded localities, and are then among the more important of our insect pests, often entirely defoliating shade and fruit trees in the section infested by them. There are, as above stated, two entirely distinct species of canker-worms, and they resemble each other so closely that they were long regarded as the same insect, and even now it requires a trained entomologist to distinguish one from the other. In their larval form both are loopers, or measuring-worms; in both, the adult male is provided with wings, while the female is wingless. In the one species the greater part of the moths appear in the fall months, going through their changes and emerging at this season; while in the other species they remain in the pupa state during the winter months and make their appearance as moths in the spring. The two species are, therefore, commonly designated as the fall canker-worm and the spring canker-worm.

The female spring canker-worm (*Paleacrita vernata*) deposits her eggs early in the spring, and the young caterpillars, as soon as hatched, commence to feed upon the new foliage. The larvæ continue to feed for four or five weeks, when, having attained their full growth, they enter the ground and pass through the pupa state.

The female fall canker-worm (*Alsophila pometaria*) deposits her eggs during November, December, and in the early part of January, and these hatch about the time the trees put forth their leaves. The larvæ attain their growth in four or five weeks, when they descend to the ground, into which they burrow for a depth of several inches; here the caterpillar forms a small cell, in which it passes the pupa state, and emerges a full-grown moth.

Comstock describes the two species, as follows:

" *The Spring Canker-Worm* (*Paleacrita vernata*).—The eggs are ovoid in shape, and are secreted in irregular masses, usually under loose scales of bark or between the leaflets of the expanding buds. The larvæ hatch about the time the trees expand, and become full grown in from three to four weeks. They vary greatly in color, and are marked on the back with eight narrow, pale, longitudinal lines, which are barely discernible; the two lateral lines of each side are much farther apart than the others; and there are no prolegs on the fifth abdominal segment. The pupa state is passed below the surface of the ground in a simple earthen cell, which is lined with very few silken threads. The adult moths usually emerge early in the spring before the leaves expand; but they

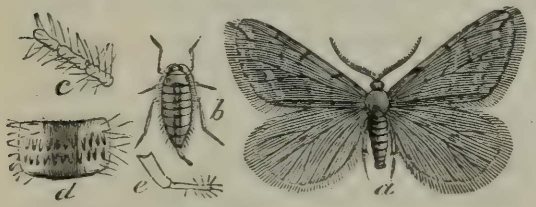


FIG. 1.
SPRING CANKER-WORM (*Paleacrita vernata*).
(*a*) Male moth.
(*b*) Female moth.
(*c*) Three joints of antennæ of female moth.
(*d*) Abdominal segment of female moth; enlarged.
(*e*) Ovipository; enlarged.

sometimes appear late in the fall, or on the warm days during the winter when the ground is thawed. In both sexes the adult of this species is distinguished by the presence of two transverse rows of stiff, reddish spines, pointing backward, on each of the first seven abdominal segments.

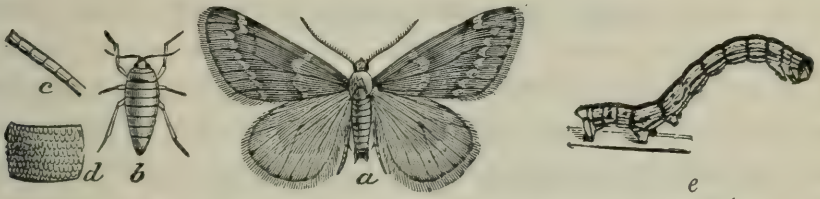


FIG. 2. FALL CANKER-WORM (*Alsophila pometaria*).
(*a*) Male moth. (*b*) Female moth. (*c*) Joints of female antennæ; enlarged.
(*d*) Segment of body of female; enlarged. (*e*) Larva of canker-worm.

"*The Fall Canker-Worm* (*Alsophila pometaria*).—The eggs appear as though cut off at the top, and have a central puncture and a brown circle near the border of the disk. They are laid side by side in regular rows and compact batches, and are generally exposed. They hatch in the spring at the time the leaves appear; and the larvæ mature in about three weeks. The larvæ is of a pale, brownish color marked with dark brown and yellow; the body is marked on the back with six broad and very distinct pale lines, those of each side equidistant; and there is a pair of distinct prolegs on the fifth abdominal segment. As in the preceding species, the pupa state is passed beneath the ground, but this species makes a perfect cocoon of fine densely-spun silk. The adult moth usually emerges in the fall, generally beginning about the middle or latter part of October; although a considerable number come out of the earth in the winter during warm weather and in the spring. The moths of both sexes lack the abdominal spines characteristic of the spring canker-worm."

Remedies.—The two species of canker-worm are so much alike in their habits that the same remedies will do for both.

The wingless female moths should be prevented from climbing the trees to

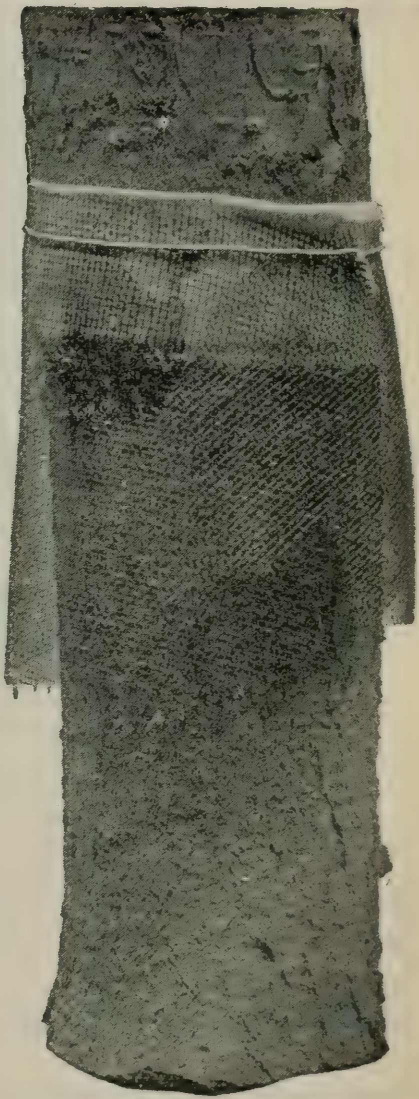


FIG. 3. Canker-Worm Moth Trap.

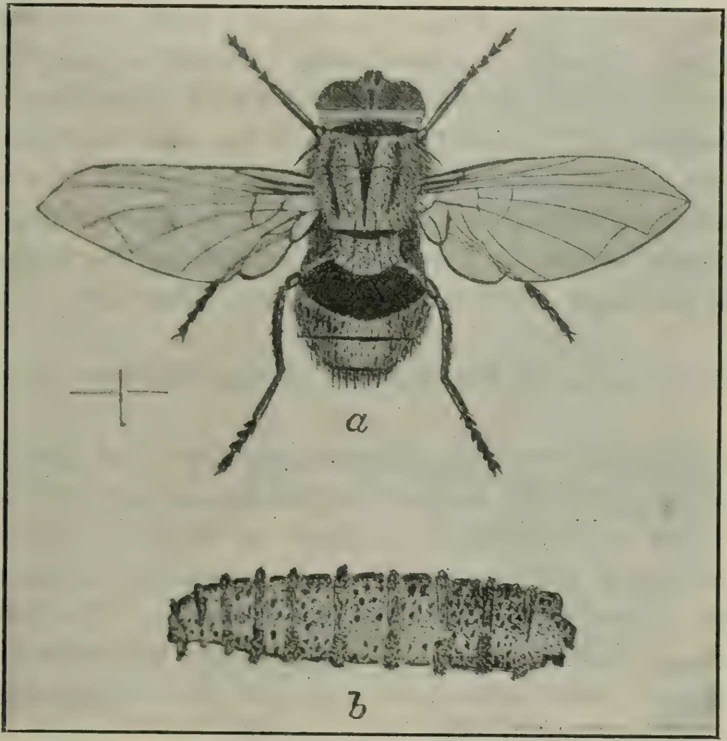
deposit their eggs in the fall. This can be done by placing a wire netting trap, as shown in Fig. 3. First place around the tree a piece of cotton batting, and then a strip of wire netting of No. 16 mesh, six or eight inches wide. Tie at top with cord or wire. See that the netting does not touch the tree at bottom. The insects will collect under it and go up as far as they can, being attracted by the light through the netting, and there perish. After the female has ceased crawling or hatching, the traps should be removed and scalded, as eggs deposited on them will hatch and the minute larvæ will get through the mesh. The trunks of the trees below the trap should also be scrubbed or coated with a thick whitewash.

Remedy against the Larva.—Spray the infested trees with one pound of Paris green to 200 gallons of cold water. To prevent the Paris green from injuring the leaves dissolve six pounds of fresh lime in water and add the latter to the solution. Keep the mixture *constantly stirred* while spraying.

THE SCREW-WORM FLY.

(*Compsomyia macellaria.*)

A couple of years ago consternation was caused in some portions of the San Joaquin Valley by the appearance of the screw-worm fly. It was probably imported from Texas, Arizona, or New Mexico, either in the larval state on cattle brought from those States, or in the pupal state or perfect fly in the railroad cars. While the damage reported from it was not great, yet the dread of its attack kept timid people in a state of alarm. It is said to occur in a large portion of the American continent, but is generally confined to the tropical or sub-tropical regions.



SCREW-WORM FLY (*Compsomyia macellaria*).
(*a*) Adult screw-worm fly, enlarged; (*b*) Larva, enlarged.
(After Francis.)

Professor Smith, in Economic Entomology, gives the following description of this fly:

"A somewhat smaller species than the blow-fly, of a very much brighter green or bluish color, with four longitudinal lines on the thorax, is the screw-worm fly (*Lucilia macellaria*). This is a common species throughout a large portion of our country, and ordinarily feeds upon dead or decaying animal matter. Under some circumstances, however, it attacks living animals, and in the Southern and Southwestern States occasionally becomes a terrible pest. On such occasions it lays its eggs on man or animals wherever there is the slightest trace of a wound, bruise, or offensive discharge of any kind. The larvæ bore directly into the living flesh, causing intense pain as well as suppurating sores. Living larvæ are produced as well as eggs almost ready to hatch, and in any opening from which there is a discharge of any kind eggs may be deposited. Sleeping humans with an offensive breath, or with a fetid discharge from the nostrils or mouth, have had eggs laid at these points, and larvæ have made their way into the head in some cases, causing the death of the individual. Eggs have also been laid in the ears of uncleanly people, and the channels and passages of this organ have been penetrated into the head and destroyed. Animals are troubled in the same way, and where the insects are abundant their attacks often become fatal. The only remedy is cleanliness. Wounds, even of the most trifling nature, on cattle should be smeared with an antiseptic ointment. As far as possible all materials in which the flies can breed should be destroyed; no accumulation of animal refuse should be allowed under any circumstances, and by strictest attention to surroundings, the breeding of the insects should be prevented. Attacking live animals is not a usual habit, although very readily assumed when the insects become abundant."

Professor Comstock, in his Manual of the Study of Insects, has the following:

"The screw-worm fly (*Compsomyia macellaria*) is a bright metallic green fly, with four black stripes on the upper part of the thorax; it measures about one third of an inch in length. This terrible pest resembles the flesh flies in habits, and it deposits its eggs in wounds, sores, and the nostrils and ears of men and cattle. The larvæ living in these situations often cause serious sickness and sometimes even death."

Several cases of death have been reported from the attacks of this fly. It is only the larva which acts as a parasite. In Texas it is a common parasite on animals, in which the fly deposits its eggs in wounds caused by dehorning, castration, barbed-wire cuts, etc., and in the horse they may be deposited in the sheath. The larvæ bury themselves deeply in the tissues, causing the formation of abscesses, and are difficult to dislodge. The fly is said to be capable of depositing several hundred eggs in a very short time. The larvæ mature in about a week and enter the ground to pupate, which they complete in from nine to twelve days.

The remedies recommended are the use of mosquito netting and protecting the mouth and nostrils while sleeping in the open air. When the larvæ have gained an entrance to the tissue the use of carbolic acid (one part to two hundred parts of water), creolin (full strength), and turpentine, applied with a syringe, has been found the most effectual. Professor Osborn recommends prompt treatment with washes of dilute carbolic acid and subsequent coating with pine tar.

Since the date mentioned in the introduction of this article the fly has apparently disappeared, its extermination probably being caused by the cold winter of the San Joaquin Valley, and it is to be hoped that it will not soon again be imported. However, the above history, description, and remedies are given, in case any section should become afflicted with this terrible pest.

CODLING-MOTH TRAPS.

At different times traps for the capture of the codling-moth have been extensively advertised, with preposterous claims as to the number of codling-moths that have been captured by them, thus inducing farmers to buy them and to waste their time and money for traps and the materials to operate them. The universal report from every competent experimenter who has tested them is that the traps are not only useless for the purposes claimed, but also exceedingly detrimental because of the many beneficial insects which they destroy.

Prof. M. V. Slingerland, Entomologist of Cornell University Experiment Station, issued a bulletin in 1902 giving the results of extensive experiments made at that station, from which we make the following extracts:

"That many kinds of insects are active at night and that some of them are then attracted by any artificial light are old and familiar truths of world-wide application, and in the ceaseless warfare against insect pests many efforts have been made to take advantage of this light-loving habit.

"Recently trap-lanterns have been much discussed as destroyers of insect pests in the northern and western portions of the United States. By the most persistent and often most unscrupulous advertising, a certain 'moth-catcher' has been forced into undue prominence, and thousands of fruit-growers and farmers have been induced to buy them, in spite of the protests of those who have thoroughly and scientifically tested such devices.

"Only those insects that fly about most actively at night are caught, and the peach-tree-borer moth and the house flies are only accidental captures, for they are most active during the day. Trap-lanterns capture only insects that can fly, and can not attract nymphs or larvæ, the stages in which insects do all their destructive work; and none of the wingless female moths, as canker-worms or tussock moths, would deliberately crawl into a trap-lantern. Another very important consideration is that many beneficial insects will be attracted and killed with the injurious ones.

"By far the most important question to consider in discussing trap-lanterns is not how many, but what kinds are caught. When the fruit-grower measures or counts the thousands of pints of insects which are sometimes caught in a trap-lantern it seems to be a valuable aid in his insect warfare and well worth the cost. But a careful inventory will usually tell a different tale, and the number of insect friends or beneficial insects will often equal and may exceed the number classed as enemies. It will be found that comparatively few of the much-desired female insects are caught, and those have already laid their eggs. A very large percentage will be the more active males."

The following is a description of the trap-lanterns used in the experiments at Cornell University:

"It was an ordinary lantern set on a brick in a common tin pan, and these were fastened to a platform on a stake. Water was poured into the pan until the brick was covered, and then enough kerosene, the killing agent, was used to form a thin film on the water. The stake raised the lantern about four feet from the ground. Six trap-lanterns were used in 1889, and were run every night from May 1st to October 1st, involving an immense amount of labor, as each lantern had to be visited twice a day, lanterns filled with oil and lighted, insects collected, and water and oil placed in pans. A single trap-lantern was run in 1892."

Trap-lantern used in the Cornell experiments.

A table was printed giving the total number of insects taken in the trap of 1892, from which we condense as follows: Total number of insects taken, 12,712; different species, over 290; number of decidedly beneficial insects, 1,330; number that are often pests, 1,604; number of neutral or rarely injurious, 9,778. The percentage of decidedly beneficial insects killed nearly equals that of the species which are often pests, and the important fact that one beneficial insect usually kills several injurious ones must be considered. Nearly one half of the captures were moths, but more than three fourths were not of economic interest and *no codling-moths were recognized.* Seventy-nine per cent of the Crambid moths, 88 per cent of the Noctuid moths, 84 per cent of the larger moths, and 93 per cent of the May beetles were males, and these proportions were almost the same in the six trap-lanterns operated in 1889. Furthermore, in most cases the females that were killed had already laid their eggs, so that their capture would not lessen the future crop. It was found that about 80 per cent of the Ichneumon or parasitic flies were females, the ones most needed in insect warfare. The male moths were doubtless seeking their mates, and the female Ichneumon flies were necessarily more active than the males, as they had to find caterpillars in which to oviposit. These facts are strong arguments against the effectiveness of trap-lanterns as destroyers of insect pests.

After citing the experiences of Professor Steadman of Missouri, who had made three different tests of trap-lanterns in three different States; of the late Dr. Riley, who had run a trap-lantern during a whole summer and failed to catch a single codling-moth; of Professor Lochhead, who had two moth-catchers near apple trees in 1901 and failed to take a single codling-moth; of the directors of several Experiment Stations, and of others, Professor Slingerland summarizes as follows:

"Thus the many attempts to capture this 'king of pests' during the past thirty years have resulted in the death of at least eleven codling-moths. The above facts are surely enough to convince any fair-minded orchardist that trap-lanterns or 'moth-catchers' will not attract or capture enough codling-moths in an orchard to pay for even the matches necessary to light them."

Professor Slingerland adds: "In brief, there is as yet no reliable evidence to show that trap-lanterns or 'moth-catchers' will noticeably check any of the common insect pests of orchard fruits, and this is also true of the enemies of small fruits. We believe that one thorough and timely application of a Bordeaux and poison spray to fruit trees will give infinitely better results at much less expense than can be obtained with any number of 'moth-catchers' around every tree. We are convinced that orchardists have no use for trap-lanterns, and that it is, therefore, time and money thrown away to use them."

L. A. Goodman has published a bulletin on moth-traps, citing numerous authorities as to their inefficiency, which corroborates all that Professor Slingerland has stated. Following are the authorities: J. M. Steadman, State Entomologist, Missouri; F. H. Speakman, Neosho, Mo.; E. P. Felt, State Entomologist, New York; Professor Garman, State Entomologist, Kentucky; E. A. Popenoe, State Entomologist, Kansas; S. A. Hoover, Normal, Warrensburg; Prof. J. Troop; S. Bruner, State Entomologist, Nebraska; F. M. Webster, Ohio Agricultural Experiment Station; E. Dwight Sanderson, State Entomologist, Delaware; Dr. L. O. Howard, U. S. Entomologist, Washington, D. C.

A CURIOUS CALIFORNIA JUMPING-GALL.

In the early part of August of the present year a gentleman brought into this office a vial containing numbers of what appeared to be small seeds, about the size of No. 6 shot, which were incessantly in motion. They were found jumping on a garden walk in the suburbs of Sacramento. The gentleman stated that he believed they were the eggs of an insect, and that the jumping was caused by the movements of the embryo therein.

An examination under the microscope proved that the shell was slightly pubescent, cellular in structure, not chitinous, as would have been the shell of an insect, and there was no doubt that the shell was of vegetable structure. Inclosed in the shell was the white larva of an insect. The objects were submitted to several persons, but no satisfactory information could be obtained of what they were, nor an explanation made of their jumping motions.

A few days later the same gentleman again appeared with an oak leaf, on the under side of which were borne a great number of small galls, which, on being removed from the leaf, commenced jumping about in a most lively manner, and proved to be the same kind as he had previously brought.

When a few of these galls were placed on a sheet and isolated so that their movements could be carefully observed, it was noticed that there were intervals of from five to ten seconds between their jumping movements, and that the distance jumped was from one quarter of an inch to one inch.

The writer had for years been familiar with these galls on the under side of oak leaves, which often have a reddish tinge and can readily be seen by any one who looks for them, but had never before seen their movements or heard of them.

On placing a few of the galls on moistened blotting paper, in a very short time they ceased moving, but on being removed to a dry position they again almost immediately commenced jumping, and continued to do so. Reasoning from this experiment, it is probably the object of their jumping to reach some moist spot, where they will remain during their larval and pupal state. The moisture will soften the gall shell, and when the insect has reached its maturity and the time arrives for its emergence it will meet with but slight resistance in its exit from the shell.

Further research showed that these galls were formed by a small hymenopterous insect of the family Cynipidæ; that in August they become detached from the leaves which bear them, and that the jumping is caused by a spasmodic movement within the thin-walled gall cavity. They are commonly known as "flea seeds," probably because they look like a seed and jump like a flea. They are indigenous to California, and are found very plentifully on the white oaks in the vicinity of Sacramento and sparingly on the scrub oaks that grow along the Sacramento River and other streams. The dweller in this gall has a most singular peculiarity. It entirely fills the small gall, which is closed, and in which it passes its larval and pupal state, and therefore, being unable to prevent its cell from becoming foul, nature has not provided an opening in its caudal extremity.

The jumping-beans of Mexico are familiar objects in the curiosity shops of San Francisco and elsewhere. In the interior of this bean is the larva of a small tortricid moth, and when the bean is warmed the movements of the inclosed larva cause the bean to move about on a smooth surface. The jumping-gall of California, however, needs no artificial aid for its movement, and is, we believe, the only gall or seed in California that has ever been known to move without outside aid. As it is of no economic importance, no attempt was made to further study its life history.

The formation of galls is most mysterious, even to the botanist and entomologist. Take, for instance, the ordinary oak ball or apple, as it is sometimes called, so plentiful everywhere in California on the oak trees. It is simply a modified leaf which has been punctured by a gall insect when it deposits its egg; at the same time the gall insect injects a poison, which transforms what would without it have grown to be an ordinary leaf, into a round ball which surrounds the inclosed larva and which has no resemblance to a leaf. If the gall is cut open and carefully examined there can be found and traced the midrib and larger venations of the leaf. In some galls the formation does not commence until the egg has been hatched, which proves that the parent insect did not inject the poison which caused distortion, but that it was caused by the larva itself.

Each variety of gall insect infests certain plants, and a trained entomologist can tell at a glance the species of gall insect which produced the gall. The galls on blackberry bushes are produced by one species, and those on rose bushes, known as "bedegars," are produced by a different variety of gall flies.

Often other species of flies, called guest flies or inguilines, lay their eggs in the galls made by the gall insects, and their larvæ feed upon the juices of the galls without any detriment to the original maker of the galls.

COLLECTION AND PRESERVATION OF INSECTS.

There have been many applications made to this office during the past summer for instructions in the capture, preservation, and mounting of insects. These have come principally from the County Horticultural Commissioners and local inspectors, among whom there is a laudable and growing interest in entomology and an increasing desire to make type collections of the injurious and beneficial insects of their various sections for comparison and exhibition. Very many of our Horticultural Commissioners have creditable collections on exhibition in their offices, and they have found this very useful as an educational means of impressing upon the fruit-grower the necessity and methods of combating the destructive species and of protecting those that are beneficial. In answer to these requests, the following paper on the collection and preservation of insects is presented:

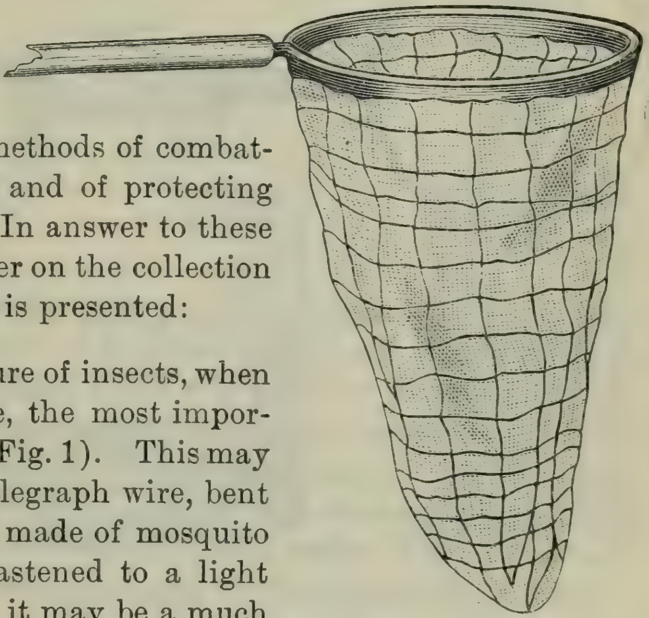


FIG. 1. Sweep Net.

Insect Nets.—In the capture of insects, when they reach the winged stage, the most important instrument is the net (Fig. 1). This may be made with a piece of telegraph wire, bent into a ring, to which a bag made of mosquito netting is attached, and fastened to a light wooden handle (Fig. 2), or it may be a much more elaborate affair, made to fold up and carry in the pocket when not in use. Its principal requisite is lightness, in order that it may be ready to throw over the insect it is desired to catch. The simplest form of the net, which can be made by almost anybody, is constructed as follows: A rod, not over five feet in length, of some light material, preferably bamboo, for a handle; a loop or ring of metal, or of some moderately stiff but flexible material, is attached to the handle; upon this a bag of fine netting, tarletan being the best material, should be sewed. The bag should be not less than eighteen inches deep and the ring not under a foot in diameter. More elaborate nets can be obtained from dealers in entomological supplies, but the average collector can make his own net with the exercise of a little ingenuity and the expenditure of a few cents for material. The net should be made of some gray or green material, as white is more likely to startle the insects and to cause them to fly when the collector is ready to throw it over them.

A heavier and a stronger form of net is required sometimes when it is desired to capture aquatic insects, or for beating low-growing shrubs, or grass. This is represented in Fig. 3.

The net must be swung swiftly to be successful. Insects have many eyes, are very wide awake, and have no desire to be caught; therefore, the collector must be very active if he gets anything. One method of using the net is called "sweeping"; to do this, take the handle about a foot and a half above the ring and pass the net quickly back and forth, striking it against the grass in front of you as you walk through open fields; the net must be turned at each stroke and kept in rapid motion, or the insects will escape. After a time the net should be examined and the insects put in the killing bottle.

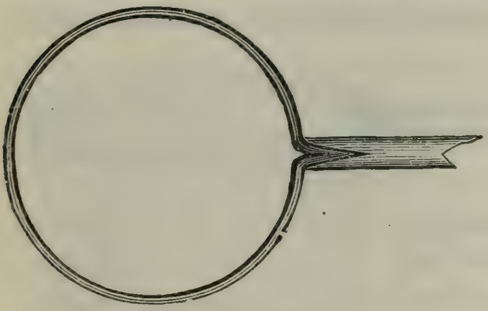


FIG. 2. Framework of Net.

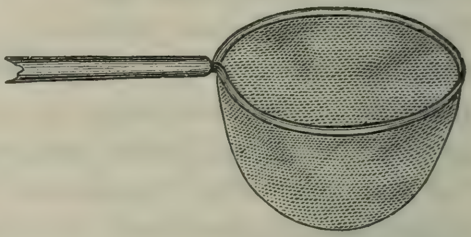


FIG. 3. Scoop Net.

Another method of using the net is called "beating." This method is used in collecting insects from bushes, and consists of lifting the net, mouth upward, and striking it sharply against the branches or leaves, thus jarring the insects into it.

To use the net in water, sweep the water plants as quickly as possible. In running streams, overturn stones, holding the net just below them, with the mouth up stream. An old dipper, made into a sieve by perforating the bottom with an awl, is a good utensil for collecting water insects.

Killing Bottle.—Any ordinary wide-mouthed bottle will answer for killing the captured insects. (Figs. 4 and 5.) An empty morphine bottle will do for ordinary insects; but for large butterflies and moths, a jar is required. These should preferably have a ground-glass stopper, as it is easier removed and replaced, but an ordinary fruit jar with a screw top will answer the purpose. In the bottom of this jar a few small pieces of cyanide of potassium should be placed; cover this with water, and pour in some dry plaster of Paris, until the water is absorbed. Leave the bottle open in a shady place for an hour and then wipe the dry plaster of Paris from its sides, put in the cork, and it is ready for use. The plaster of Paris forms a porous cement, which, while it holds the cyanide of potassium fast in the bottom, also allows the fumes of the poison to escape and fill the bottle. It should be labeled "poison." If kept corked when not in use, a killing bottle made like this will last a whole season. When they are captured, the insects are dropped into the poison bottle, the fumes of which overcome them in a few seconds. In the case of butterflies and moths the insects should, if possible, be transferred from the net to the bottle without handling, as even the most careful handling will damage these delicate insects. Some collectors carry a small bottle of chloroform (Fig. 6) and put a drop or two in the killing bottle. This causes instantaneous death, and the insects are not damaged by fluttering and beating their wings against the sides of the bottle. Do not breathe the fumes of the bottle, for they smell bad and are not good for you. When you open the bottle to put an insect in it, hold it away from your face and cork it up again as quickly as possible.

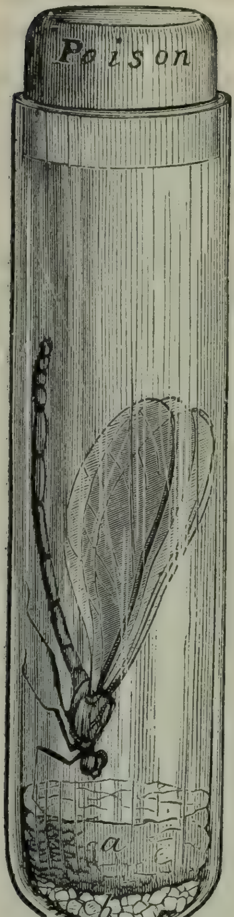


FIG. 4. Cyanide bottle.

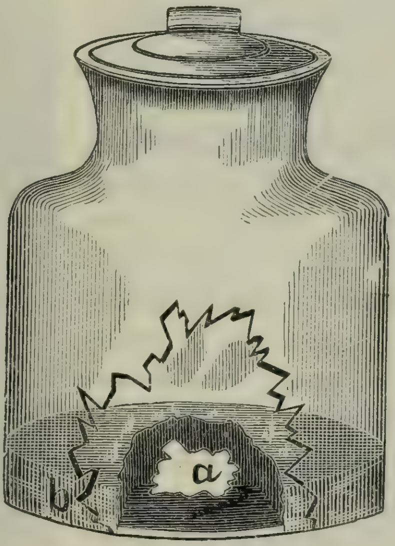


FIG. 5. Another form of cyanide bottle.

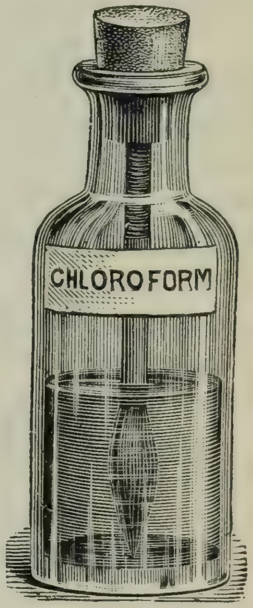


FIG. 6. Chloroform bottle and dipper.

Some insects may be caught from flowers, etc., directly into the bottle, by holding it uncorked beneath them for a moment; the fumes of the poison soon overcome them and they drop into the bottle.

In taking insects from the net, take the bottle in the right hand and the cork in the left; insert the bottle into the net, and place the mouth of it over an insect crawling on the inside of the net; then put the cork on the outside of the net into the mouth of the bottle, net and all, for a moment until the insect falls into the bottom of the bottle; then remove the cork and take the rest of the imprisoned insects in the same way. Insects should be left in the bottle at least an hour, and may be left in there over night without injury to the specimens.

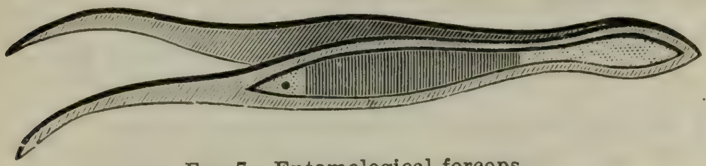


FIG. 7. Entomological forceps.

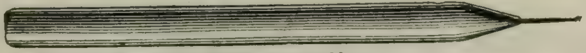


FIG. 8. Setting needle.

For removing insects from the bottle, a pair of forceps (Fig. 7) will be found of much use, especially in handling smaller and more delicate species. A supply of alcohol and a few small bottles for preserving soft-bodied insects, caterpillars, etc., should form a part of every collector's outfit.

Preservation of Specimens.—If it is not desired to mount the specimens immediately after their capture, a large part of them, such as the beetles, and other insects which will not be damaged by it, may be preserved in alcohol. With butterflies and moths it is usual to inclose them, with their wings folded, in small envelopes, when they may be stored in a box until wanted. Small drug envelopes are suitable for this purpose, or the collector may make his own envelopes from flat paper folded as shown in the accompanying diagrams (Figs. 9 and 10). A little naphthalene should be placed in the boxes containing the dry specimens, in order to keep out mites and insects which are liable to injure the specimens. For this purpose, Bishop's moth-ridder, which comes in flakes, is as good as anything, and a small amount scattered among the papers will be effective.

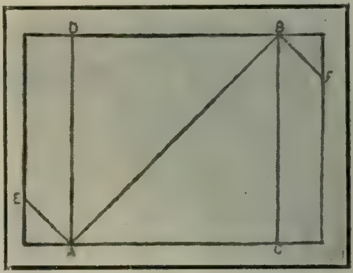


FIG. 9. Method of folding paper for envelope. First fold on the line A B, then on A D and C B, and then on B F and E A.

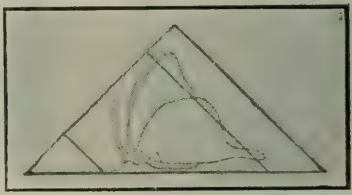
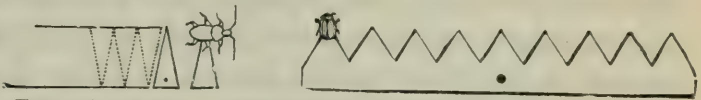


FIG. 10. Butterfly in envelope.

Mounting Specimens.—For mounting insects a good supply of naturalist's pins is required. These are longer and more slender than the ordinary pins, and have smaller heads. They are much better than the common pins, which, besides being too thick, soon corrode, cover the specimen with verdigris, and render it valueless. The best pins for the purpose are German insect pins numbered from 1 to 5. The No. 1 size is very delicate and is used only for the smaller insects; No. 5 is suitable for very large insects; No. 3 is the most serviceable size. These pins can be purchased from any dealer in naturalist's supplies at 15 cents per hundred.

In mounting beetles the pin is thrust through the right elytra or wing cover, leaving about one third of the length of the pin projecting above. In the true bugs the pin should be inserted through the scutellum, the triangular piece at the base of the wings. In other insects, such as moths, butterflies, bees, flies, etc., the pin is inserted directly through the center of the thorax. The cuts accompanying this paper will give a good idea of the method of pinning the different classes of insects. Small insects are best mounted on triangular pieces of cardboard, as it is difficult in many cases, and impossible in some, to thrust even the most delicate pins through them without destroying them. These points may be cut from light bristol board and should be about three eighths of an inch long, as shown in Figs. 11 and 12. A pin is inserted in the base of this, and the point is touched with mucilage, prepared glue, or other adhesive preparation. The insect is placed on its back and the prepared point is touched to its under side. By this method it can be picked up without difficulty.



FIGS. 11 and 12. Cardboard points for mounting small insects.

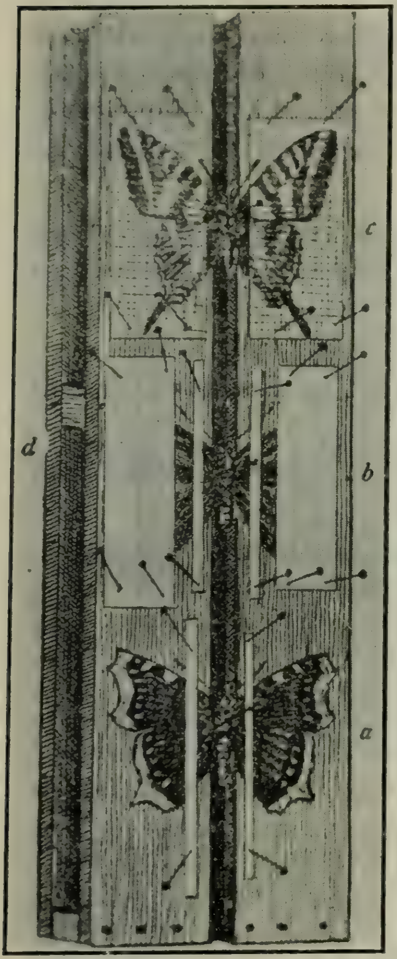


FIG. 13. Spreading-board for Lepidoptera.

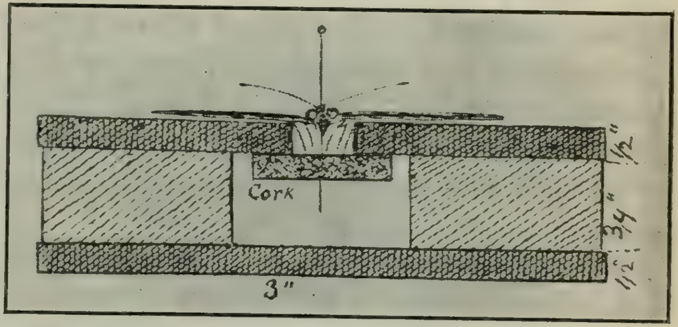


FIG. 14. Sectional view of spreading-board in front of cleat "d" in Fig. 13.

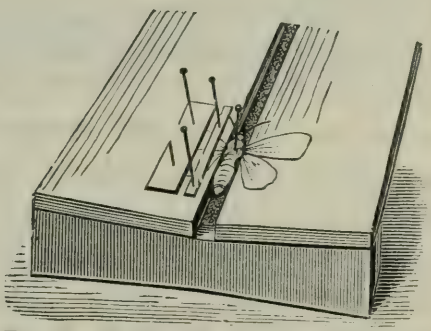


FIG. 15. Method of spreading butterfly on board.

For butterflies, moths, and other insects in which the wings are to be spread, a spreading-board is needed. A very good idea of this can be had from the illustrations (Figs. 13 and 14). It is easily made, consisting of two thin strips of half-inch pine board, 12 to 16 inches long and 1½ to 3 inches wide. These are fastened to cleats on the under side to hold them together, while a space varying in width to admit the bodies of different sized insects is left between them. On the under side of this space a sheet or strip of thin cork is fastened. The pin on which the insect is fastened is pushed through this cork, and the body inserted in the open space between the strips until the wings are on a level with the surface of the board. The wings are then brought forward until the posterior borders of the front ones are at right angles to the body, where they are held in place by strips of writing paper or thin cardboard, as shown in the illustration (Fig. 15). When the insect has been properly spread it should be put away on the mounting-board and left for a week or ten days to dry. After this time it may be carefully removed from the board and put in place in the collection.

Mrs. Anna B. Comstock, of Cornell University, gives the following instructions and illustrations (Figs. 13 and 14) for making spreading-boards:

"Materials needed for a medium-sized spreading-board:

"First—Two strips of pine or other soft wood 18 inches long, 1½ inches wide, and ½ inch thick.

"Second—One strip of wood 18 inches long, 3¼ inches wide, and ½ inch thick.

"Third—Two cleats 3¼ inches long, ¾ inch high, and ½ inch thick; and two cleats 1 inch long and as high and thick as the others.

"Fourth—A strip of cork or linoleum 17 inches long and a little less than an inch wide.

"To construct the spreading-board take the two narrow strips of wood, place them one fourth of an inch apart, and on the under side fasten them across the ends to the longer cleats. Then on the same side as the cleats tack a piece of cork or linoleum over the space between the strips of board, and as the cleats are over one half inch wide the linoleum should cover all the space left. Then midway on the boards fasten the two smaller cleats. Fig. 14 shows a cross-section of the spreading-board just in front of these two middle cleats. Now it is ready for the bottom board, which will fit exactly if directions are followed, and this completes it. The space between the two upper boards is wide enough to take in the body of the moth or butterfly. The cork or linoleum below the space will hold firmly the pin on which the butterfly is impaled. The cleats hold the top and bottom boards apart, and so protect the points of the pins. Spreading-boards may be made much smaller or much larger to suit."

In mounting dried specimens it will be necessary to relax them, and for this purpose they are placed in a covered box in which is a shallow layer of damp sand, over which a sheet of thin paper has been placed.

After remaining on this for from twelve to twenty-four hours, the insects will become pliable, and can be set on the board and put away to dry permanently. In handling insects, and especially in mounting the smaller and more delicate specimens, an almost indispensable instrument is the setting needle (Fig. 8). This may be an ordinary sewing-needle inserted in a wooden handle, or a more elaborate instrument prepared for the purpose and sold by the supply dealers. The one, however, is no better for the work than the other.

Insect Boxes.—After his insects are mounted, the next requirement of the collector is a receptacle of some kind in which to keep them. This may be anything from an ordinary cigar box to a highly-finished cabinet, costing hundreds of dollars. For beginners, cigar boxes answer the purpose very well. They should be lined with cork, pith, or linoleum. The pith of the flower stem of the century plant, cut in sheets about three eighths of an inch thick, answers the purpose admirably, and in most parts of our State is very easily procured. For permanent collections, or for exhibition purposes, a more elaborate case is required. A good size for these we have found to be 15 by 21 inches and 2¼ inches deep in the clear. This should have a glass cover made to fit tight, so that all dust and insect pests can be excluded. Mrs. Comstock recommends a box 18 by 16 inches for school collections, and gives the following details for construction:

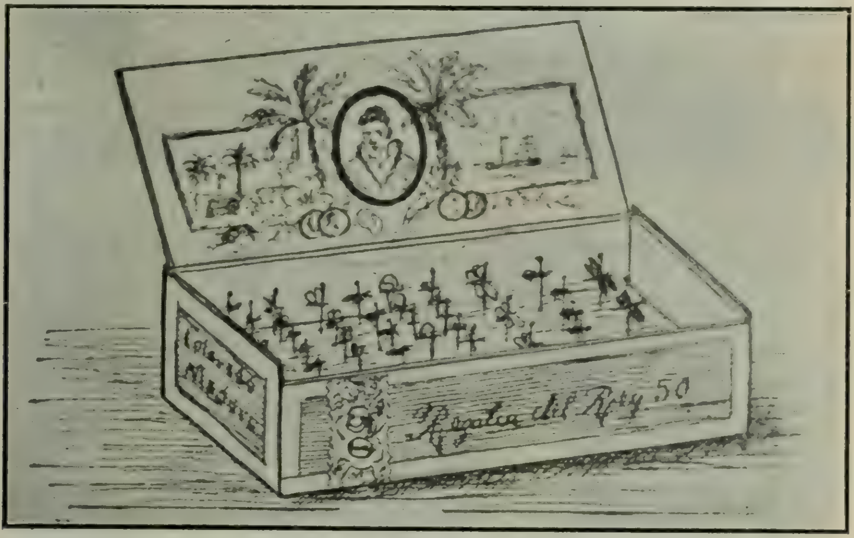


FIG. 16. A cigar-box insect case.

"For permanent collections the wooden boxes with glass tops are much safer; and as the insects may be seen through the glass these boxes are more practical for school collections. This kind of a box is shown in Fig. 17. Its sides are 18 by 16 inches and its height is 3 inches, outside measure. The upper edge of the sides of the bottom of the box is made with a tongue which fits in a groove made in the lower edge of the sides of the cover. This is done so that the top and bottom parts of the box shall very fit very closely together in order that the museum pests can not get in and destroy the specimens. The glass might be puttied in, like a window pane, if it is found difficult to make the groove. The corners of the box may be mitered and dovetailed, or mitered and nailed; the latter is more easily done. Any carpenter or cabinet-maker can make this box; but great care must be taken to use only thoroughly seasoned wood in its construction. Otherwise, the bottom will be sure to warp and shrink and leave cracks through which the museum pests will enter. Pine is not at all suitable, on account of the resin in it. Screw-eyes may be put into these boxes and they may be hung on the walls of a schoolroom, like pictures."

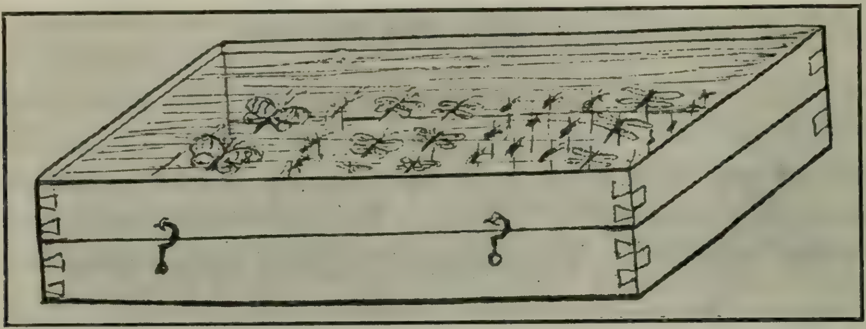


FIG. 17. A cheap exhibition case, with glass top.

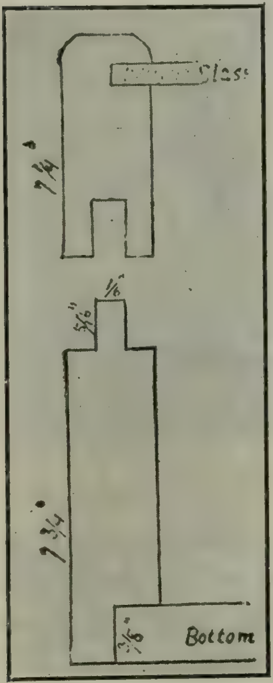


FIG. 18. Cross-section of side of insect box (Fig. 17), showing method of construction and giving measurements.

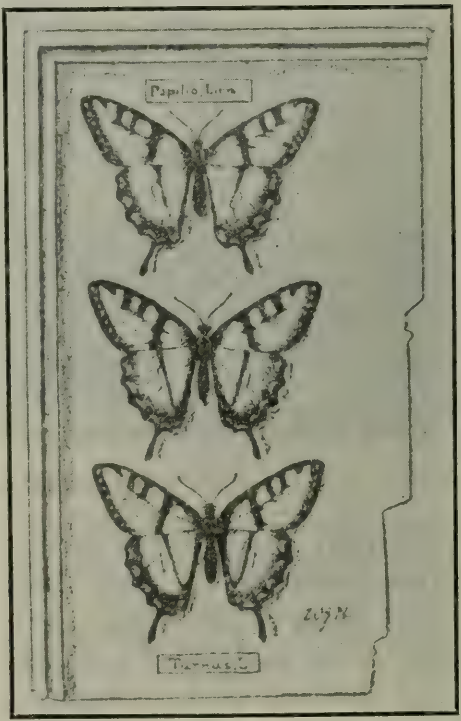
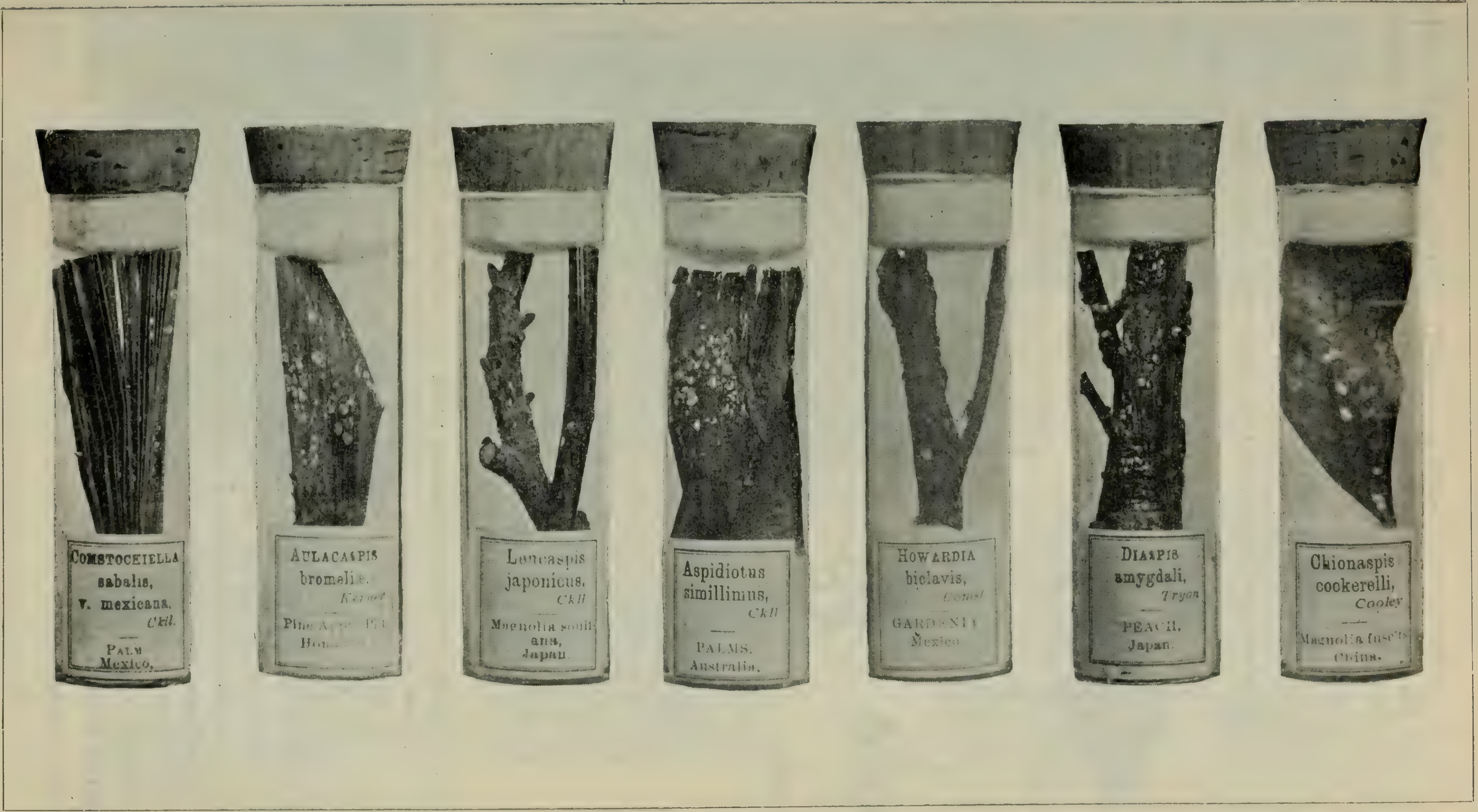


FIG. 19. Method of mounting Lepidoptera in cabinet cases.



ALEXANDER CRAW'S METHOD OF PRESERVING SPECIMENS OF SCALE INSECTS FOR THE CABINET.

For the preservation of scale insects, Mr. Craw has devised a very excellent plan of putting them up in small vials, which he describes as follows (see illustrations on page 167):

"The method is to take a little naphthaline flakes or camphor in the bottom of the vial, covered with a little cotton; this prevents injury to the specimens by cabinet mites. The cork or stopper is pressed in, together with a little absorbent cotton, and the latter trimmed off even with the edge of the vial, making a neat finish. Before placing the infested twigs in the vial, they are subjected to the fumes of C. P. cyanide of potassium for a few hours, or are fumigated with hydrocyanic acid gas, and then placed between blotting paper, without pressure, until all moisture has evaporated. The specimen is then placed in the vial as near as possible to the glass, so that it can be readily examined with a lens without having to remove it. The specimen is cut long enough so that the cotton on the cork touches it, and this holds it in position, preventing it from shaking about in the vial and injuring it. The name of the scale, together with the name of the food plant and habitat of the insect, are printed upon neat labels and gummed to the base of the vial. This record is of importance, as it may be the means of determining where to search for the natural enemies of a species of scale insect."

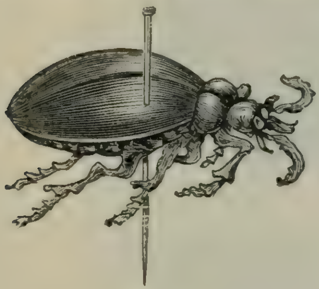


FIG. 20.

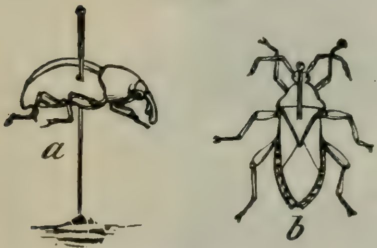


FIG. 21.

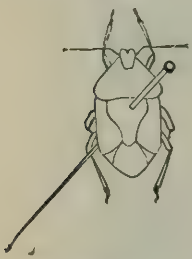


FIG. 22.

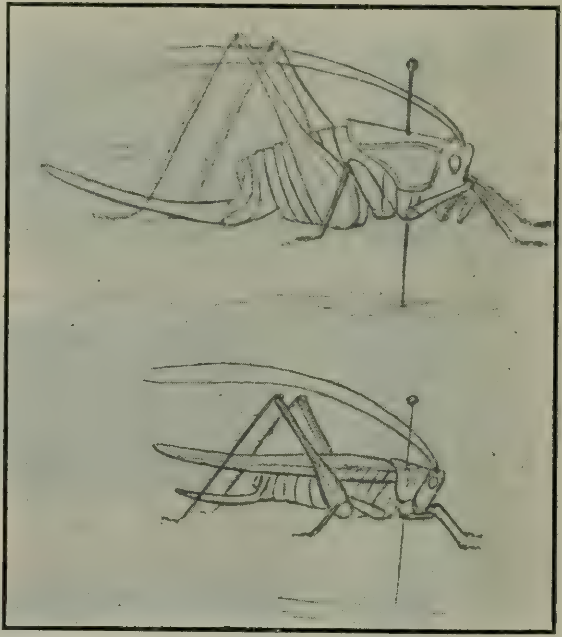


FIG. 23.

METHODS OF PINNING DIFFERENT CLASSES OF INSECTS.

Museum Pests.—In order to preserve collections, great care must be taken to exclude all pests which prey upon them. Among the worst of

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NOTE.—Illustrations Nos. 13, 14, 16, 17, 18, and 23 to 28 are from Mrs. A. B. Comstock.

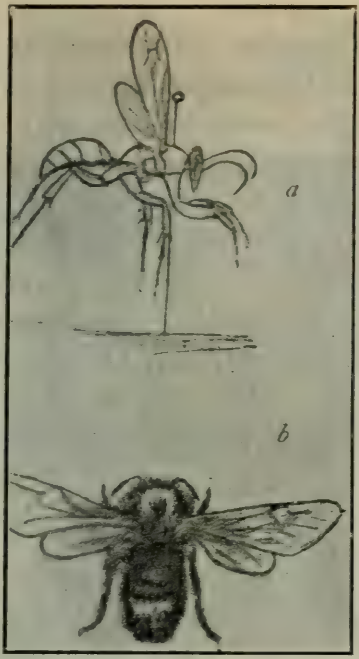


FIG. 24.

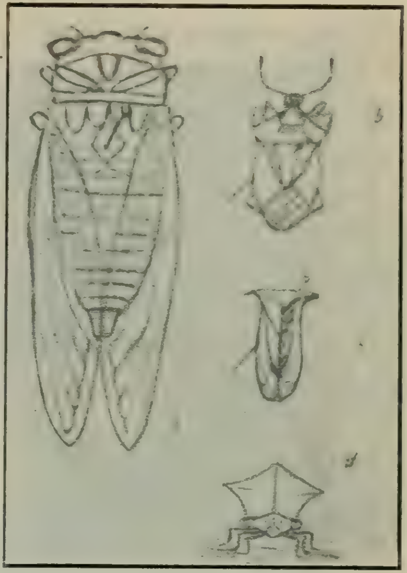


FIG. 25.

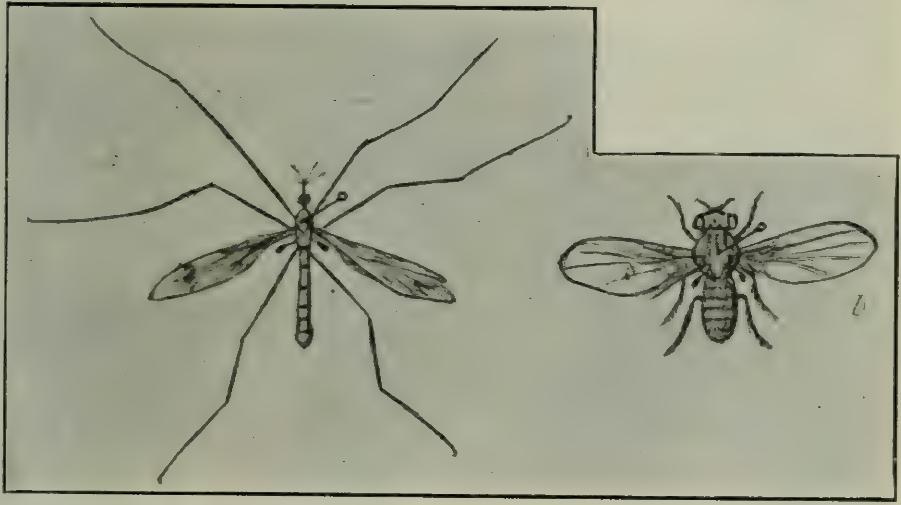


FIG. 26.

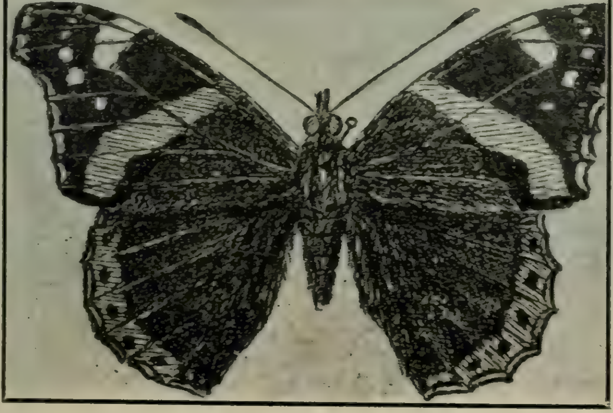


FIG. 27.

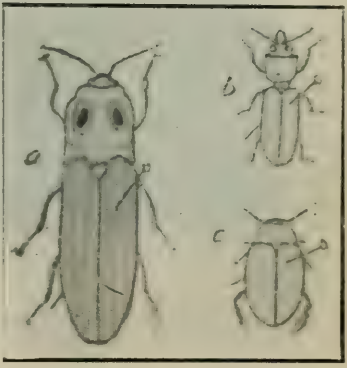
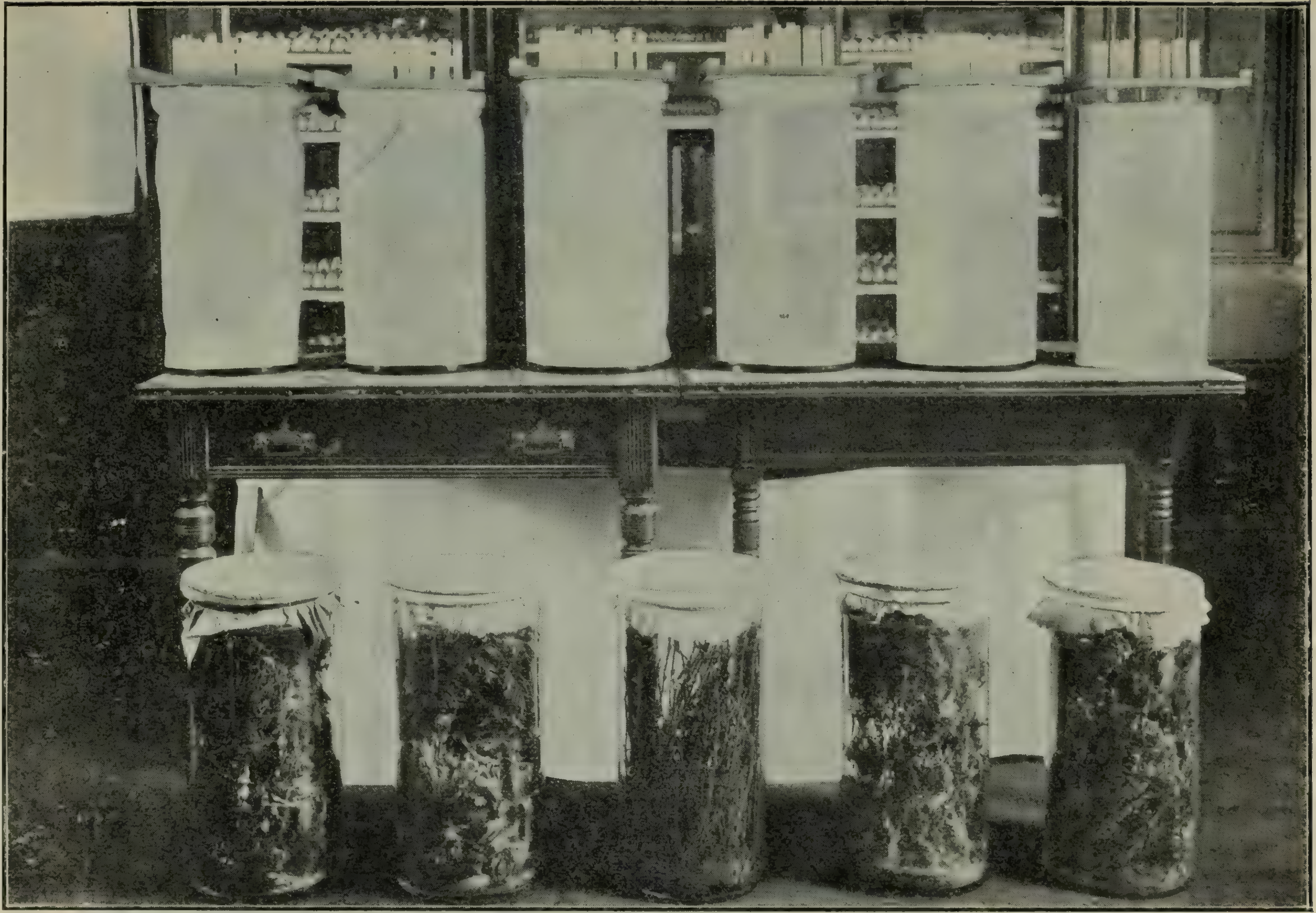


FIG. 28.

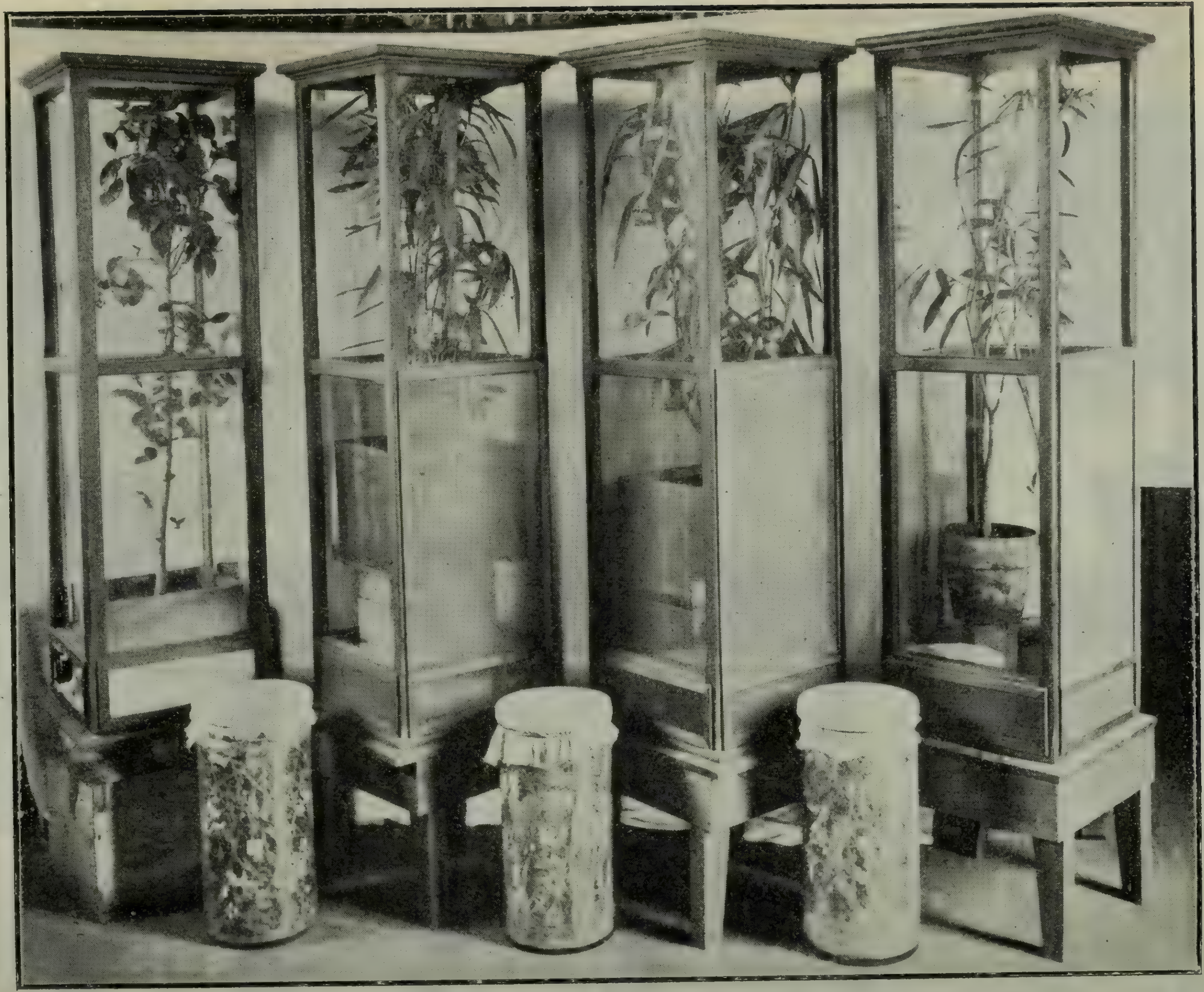
METHODS OF PINNING DIFFERENT CLASSES OF INSECTS.

these are some small beetles belonging to the genus Dermestes and Anthrenus, which find entrance through the smallest opening and lay their eggs upon the dried specimens. The larvæ work unseen within the bodies of the pinned insects, and in time cause their total destruction. To prevent this a piece of naphthaline, an ordinary moth ball will do, should be kept pinned to one corner of the specimen case; and if at any time a small quantity of fine dust is observed under the pinned specimen it is evidence that the pest is at work. A spoonful of bisulphide of carbon may be poured into the box, which should be closed quickly and left. Benzine will answer the same purpose, but as this is highly inflammable, it should never be used in the presence of a lighted lamp or near fire of any kind.



INSECT BREEDING-JARS, SHOWING METHOD OF BREEDING AND CAPTURING BENEFICIAL INSECTS FOR SHIPMENT.

The insects are bred in the jars, as shown in the lower part of the illustration. In order to capture them, the jars are darkened, as shown in the jars on the table. A board cover is placed over each jar and this is filled with half-inch holes. Into each of these holes a small vial is tightly fitted. The insects work up to the light, and when a colony has entered a vial, it is replaced by another, and the captured colony packed for shipment.



BREEDING-CASES FOR BENEFICIAL INSECTS, IN SAN FRANCISCO OFFICE.

MISCELLANEOUS PAPERS.

WOODPECKERS.

The birds belonging to the woodpecker family are the best friends the farmer has among the feathered tribe, performing services that no other bird is capable of doing, because of the peculiar structure of their bills and particularly of the tongue. The little damage caused by woodpeckers in an orchard is compensated more than a hundredfold by the good they do. In orchards frequented by woodpeckers the damage done by the larvæ of wood-boring and bark-boring coleopterous insects is reduced to a minimum, and these birds should never be permitted to be wantonly killed.

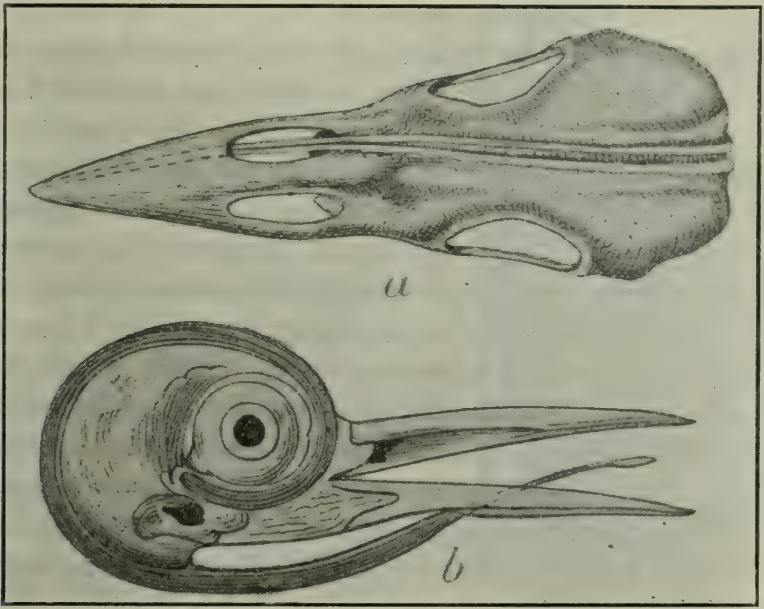


FIG. 1. Special development of tongue of Woodpeckers: (*a*) Skull of Flicker (*Colaptes auratus*), showing root of tongue extending to tip of bill (after Lindahl); (*b*) Head of Hairy Woodpecker (*Dryobates villosus*), showing root of tongue curving around the eye (after Audubon).

There are many varieties of woodpeckers in California, but the most numerous and conspicuous is the red-headed, of which there are several varieties. However, their habits are almost identical and all are beneficial.

The tongue is the most peculiar part of the anatomy of these birds, as a reference to the cut will show. The following description is taken from the Year Book of the U. S. Department of Agriculture for 1900: "The tongue is extended backward by two slender filaments of the hyoid bone, each incased in a muscular sheath. These filaments, instead of ending at the back of the tongue, curve up over the back of the skull, across the top of the head, and down on the forehead, and in some species enter the opening of the right nostril and extend forward to the end of the beak, as in the flickers. In other species it enters the head and curves around the eye. The tongue is practically twice the length of the head. By means of the surrounding muscular sheath, the tongue can be protruded from the bird's mouth a considerable portion of its length, and can thus be inserted into the burrows of wood-boring larvæ. In order to secure grubs or other insects it is usually furnished with a sharp point and is barbed on the sides." [The common woodpecker of this State has the horny plate on the end of the tongue rather blunt, and on the sides are hair-like appendages which lie pointing backward from the tip, but when inserted in a larva and withdrawn, the hair-like forms stand out at right angles to the tongue, thus insuring a firm hold on the grub.] "It is evident that a bird possessing such an apparatus must be capable of doing work which less advantageously endowed species can not accomplish. Hence, while most birds content themselves with eating such insects as they find on the surface, woodpeckers seek those larvæ or grubs which are beneath the bark or even in the heart of the tree. To render more effective the mechanism here described, these birds are gifted with a remarkably acute sense of hearing by which to locate their prey within the wood. That they do so with great accuracy is disclosed by examination of their work, which shows that they cut small holes directly to the burrows of the grubs."

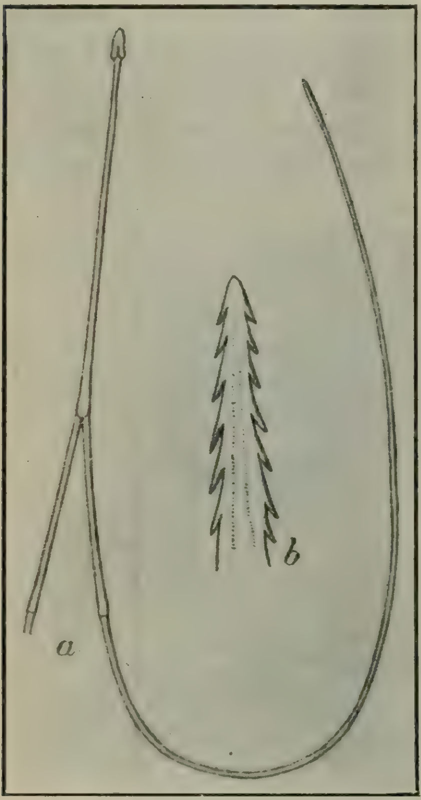


FIG. 2. Tongue of Woodpeckers: (*a*) Hyoid bone of Flicker (*Colaptes auratus*); (*b*) Tip of tongue of Downy Woodpecker (*Dryobates pubescens*). [U. S. Year Book.]

Woodpeckers are active and noisy birds. When searching for food they usually alight near the base of the tree and then, ascending, search every nook and crevice for a pupa, hibernating insect, or eggs, which they greedily devour. In orchards infested with the codling-moth they destroy many of them. They are also great destroyers of ants, which, it is stated, constitute twenty-three per cent of their food.

The flicker, however, does the best service in the destruction of ants, and it is mentioned that two stomachs which were examined contained more than 3,000 ants. Besides catching them on the trees, it also obtains many on the ground, which it visits mainly for this purpose. It will excavate to a considerable depth a nest of ants by means of its bill, removing great mouthfuls of dirt at a time, and devouring ants, grubs, and eggs. It will puncture a row of holes on the trees from which the sap exudes, which attracts ants, afterward revisiting the trees on which the holes are located to capture the ants. Flickers are sometimes guilty of boring holes in the sides of houses for nesting or storage purposes, but generally they are not harmful.

Woodpeckers are very provident birds, storing acorns, etc., for future use. They bore holes in trees, generally in dead wood, in which they store great numbers of acorns, with the end to which the cup was attached pointing outward. The acorns can readily be removed from the dead wood, but not from the green wood after they have been in the holes for a few days, which has led many people to believe that the woodpeckers bore the holes only sufficiently large to receive the acorn, which is then forced into the hole so tightly as to prevent its removal without destroying it. But such is not the case. In the fall of the year, when woodpeckers are engaged in storing acorns, the sap which has been elaborated in the leaves is descending and rapidly forming wood; so that, while the hole which the woodpecker made in the wood for the reception of the acorn was sufficiently large to enable the woodpecker to insert it easily, in a few days the wood grows tightly around the acorn, preventing its extraction.

Almond orchards suffer somewhat from the depredations of woodpeckers, not so much from what they eat while in the orchard as from the quantity they carry away to store. Near Farmersville, in Tulare County, was a large oak tree with an opening in it some distance from the ground. The tree was hollow, with another opening close to the ground. Near by were almond trees, the nuts of which the woodpeckers would gather, and, after hulling, would drop them into the topmost hole, and from the lower hole the thrifty farmer removed more than a bushel in one season.

There is one species of woodpecker which, without doubt, is injurious to the horticulturist. It is the yellow-bellied woodpecker, commonly called the "sapsucker." This bird injures trees, generally in the spring when the sap is flowing, by pecking numerous holes very close together, oftentimes completely girdling the tree, and sometimes destroying it. The bird does this for the purpose of eating the soft tissues of the inner bark and sapwood. It also drinks the sap which accumulates in the pit and devours the insects that are attracted by the sweetness of the sap. From this fact the sapsucker may be easily destroyed in the following manner, according to President Ellwood Cooper of this Board: Mix honey and strychnine together and smear the tree that has been punctured by the sapsucker, immediately above the row of holes, so that the poisoned honey will flow downward and mingle with the sap. The sapsucker on his return will imbibe the sap and with it the poison.

Sapsuckers are difficult to shoot in an orchard, because they will move around to the opposite side of a tree from a person and when taking wing will have the brush of the tree between him and his enemy. An old United States Year Book gives the following as the means of killing woodpeckers, which we quote without recommendation:

"As a means of protecting fruits a bare pole is placed beside a tree and reaching a little higher than its summit. Upon this the bird alights by preference, when a blow given to the pole below will produce such a vibration as will cause the bird to fall dead."

Sapsuckers are generally residents of the lower foothills, but in spring they migrate to the valleys, and it is at this time of year that they are most injurious to fruit trees.

WINTER IRRIGATION OF DECIDUOUS ORCHARDS.

In many sections of California where it is necessary to irrigate deciduous orchards the supply of water in the summer time, when irrigation is most practiced, is short and inadequate to the demand, yet there is an abundance of water in the winter time, but which is allowed to run to waste. That it is possible to utilize this wasted winter supply and store it for use in the growing season during summer has been demonstrated by experiments made by A. J. McClatchie, of the Arizona Experiment Station.

The climate and soils of Arizona are similar to our own in many sections where irrigation is practiced. What has been successful there should likewise prove so here under similar conditions.

Growing plants have need of more water than is generally supposed. Professor King, of the University of Wisconsin, made experiments to determine the amount of water necessary to produce a ton of dry matter of barley, corn, peas, potatoes, etc., and found that it would require an average of 450 tons of water to produce a ton of dry matter. An inch of water equally distributed over an acre will weigh about 113 tons.

Professor McClatchie, in his experiments in the winter irrigation of deciduous orchards, applied about 3 feet of water, beginning December 16th and continued to March 5th. No irrigation was applied for eight months, during which time the rainfall was but 2½ inches, and the results were most satisfactory. Though the summer during which the experiment was tried was unusually dry, the trees maintained vigorous growth, and at the end of the driest, hottest spell during May and June of which there was any record in that Territory, the orchard showed no signs of drought whatever, peach trees making a growth of about 4 feet, and apricot trees of 3 to 6 feet. The apricot trees during the hot period matured an excellent crop of fruit, and the peach trees in July and August matured an unusually heavy crop of fruit. Though having received no irrigation for eight months, no thriftier or more vigorous orchard existed, although many orchards died in the valley in that vicinity.

Professor McClatchie gives the following as the advantages of winter irrigation and the reasons for the effects:

"During the winter the lower temperature and the higher relative humidity cause evaporation to be much slower than during the remainder of the year. In applying water, therefore, comparatively little escapes into the atmosphere. The supply of water being greatest at that time of the year, makes it possible to apply large amounts at short intervals, thus avoiding the loss that occurs if small amounts are applied at greater intervals. Then, too, the trees are dormant and roots need little air, hence no injury is done them by keeping the soil super-moistened or by letting the surface bake to some extent. Consequently cultivation after each irrigation is not necessary, much time being thus saved.

"Trees make use of and consequently need water much earlier than is commonly supposed. An examination made February 20, 1900, revealed that at the depth of 10 to 16 feet even young roots 3 to 6 inches long had already grown. At this date there were few above-ground indications of growth, and it would not have been supposed by making a casual observation that the trees would make use of any water that might be applied. While the air above ground is still too cool to start development of the buds, the roots far beneath the surface are making a growth that prepares the tree for the demand for water that the leaves will make later. Thus, if the trees have an abundance of water during the winter, the early root growth that will be made will enable them to make a rapid growth as soon as the air above ground is warm enough to permit it. These facts account for the rapid and vigorous growth that the winter-irrigated orchard made in early spring compared with those that had not been irrigated."

The soil on which this orchard grew was composed of the first 6 feet of loam, then about 7 feet of fine gravel, about 1 foot of clay, 2 feet of gravel, about 16 feet of clay, and last about 2 feet of clay and gravel, when the ground water was reached at the depth of 34 feet. Roots in abundance were found penetrating the clay and gravel at a depth of 12 and 16 feet, and many were traced beyond 20 feet.

An examination of the moisture content of the soil showed "that the total loss of water from the upper 25 feet during the spring, summer, and autumn was about 20 inches. Deciduous orchards use and need the major part of the water-supply during spring and early summer, which need can be best supplied in most of southern Arizona by filling the subsoil with water during winter."

The conclusions of Professor McClatchie are as follows: "The amount of water needed by a deciduous orchard to keep it in good condition in southern Arizona from March to November is about 21 inches, which can be stored in the soil by the application of about 3 feet during winter. The amount that need be applied to grow a green-manuring crop and store enough water in the soil to carry a deciduous orchard through the summer is about 4 feet. Deep winter irrigation followed by thorough summer cultivation is better for deciduous orchards in southern Arizona than the frequent application of small amounts of water during the growing season. If about the middle of the summer water is available in abundance, it would probably be wise to give the orchard a thorough irrigation in as short time as possible, and then follow the irrigation with a thorough plowing, as in the spring after the winter irrigation ceases. But frequent summer irrigations are decidedly not advisable under our conditions, where the soil is fairly deep and retentive of moisture."

Another advantage to be gained by keeping the subsoil well moistened is that the roots will form at a greater depth and not near the surface as when summer irrigated, and will not dry out or be subject to fluctuations of growth between irrigations in summer.

When the deficiency of rainfall is apparent by the first of March in this State, it would be wise for horticulturists who have an abundance of water at that time of year to irrigate their orchards sufficiently to at least bring the amount of water up to what would be precipitated in an average heavy seasonal rainfall, which could do no harm. Experiments in the future, we have no doubt, will prove that it is better and more economical to store water in irrigated lands in the subsoil of farms than in more expensive reservoirs.

But there are sections in California where it might not be wise to winter irrigate and fill the subsoil with water. In alkali districts this might cause the rise of salts to the surface, which would prove injurious to the orchards. But in non-alkaline districts we have no doubt it would prove as beneficial as the experiments in Arizona have shown, whose soil, climate, and rainfall are not dissimilar to our own.

INFLUENCE OF WIDE TIRES AND HEIGHT OF WHEELS ON DRAFT OF WAGONS.

The Agricultural Experiment Station of Missouri has been making tests of the influence of the width of tires and the height of wheels on the draft of farm wagons, from which we copy a summary of the results and conclusions drawn.

It is estimated that the public roads of the United States aggregate 1,500,000 miles in length and that the total wagon transportation is approximately 500,000,000 tons. The average distance of haul is placed at eight miles, and the average cost of transportation for one ton for this distance is assumed to be $2, making the total yearly cost for wagon freighting $1,000,000,000. It is claimed that this freight could be transported the distance of eight miles over first-class roads at an average cost of 80 cents per ton. On this basis, a saving of $600,000,000 a year in the cost of wagon transportation could be effected by having first-class roads in all sections of the country. The magnitude of this saving will be better appreciated when it is realized that it amounts to one fourth of the value on the farm of all the farm products of the United States.

Numerous tests of the draft of wide and narrow tired wagons were made on macadam, gravel, and dirt roads in all conditions, and on meadows, pastures, and plowed fields, both wet and dry. The net load was in every case 2,000 pounds, and, contrary to public expectation, in a large majority of cases the draft was materially less when tires 6 inches in width were used than when the tests were made with tires of standard width—1½ inches.

On a macadam street a load of 2,518 pounds could be hauled on the broad tires with the same draft that a load of 2,000 pounds could be hauled on narrow tires.

In all conditions of the gravel road, except wet and sloppy on top, a load of 2,482 pounds could be hauled on the broad tires with the same draft required for a load of 2,000 pounds on the narrow tires.

On dirt roads, when dry and hard, and free from ruts and dust, 2,530 pounds could be hauled on the broad tires with the same draft required for 2,000 pounds on the narrow tires. With the dust two or three inches deep, the results were unfavorable to the broad tire, and it was the same when the roads were muddy and sticky on the surface and firm underneath. With the mud deep and drying on top, or dry on top and spongy underneath, it was unfavorable to the broad tires. As the road dries and becomes firmer, the difference between the draft of the broad and narrow tires gradually diminishes, until it reaches about 25 to 30 per cent on dry, hard, smooth dirt, gravel, or macadam in favor of the broad tire. When mud becomes soft and deep, the difference between the draft of the two types of wagon rapidly diminishes, and finally the narrow tires pull materially lighter.

A large number of tests on meadow pastures, stubble land, corn ground, and plowed ground in every condition, from dry to very wet, show a large difference in favor of the broad tires, ranging from 17 to 120 per cent. When it is considered that most of the freighting done by the farmers is on the farm itself, this saving of draft should have a serious consideration.

Numerous tests of the drafts of wagons with wheels of different heights were made. Standard, front wheels 44 inches, rear wheels 55 inches; Medium, front wheels 36 inches, rear wheels 40 inches; Low, front wheels 24 inches, rear wheels 28 inches. The following is a summary of the results:

For the same load, wagons with wheels of standard height draw lighter than those with lower wheels, and the difference was greater on road surfaces in bad condition than on good road surfaces.

Low wheels cut deeper ruts than those of standard height, and the vibration of the tongue was greater in wagons with low wheels.

For most purposes wagons with low wheels are more convenient than those of standard height.

Wagons with broad tires and standard wheels require much room in turning.

Diminishing the height of wheel to 30 from 36 inches in front and 44 to 40 inches in rear did not increase the draft in as great proportion as it increased the convenience of loading and unloading ordinary farm freight; but diminishing the wheels below 30 inches in front and 40 inches in rear increased the draft in greater proportion than it gained in convenience.

On good roads, increasing the length of rear axle so that front and rear wheels will run in different tracks to avoid cutting ruts did not increase the draft; but on sod, cultivated ground, and bad roads, it did.

The chief drawback to the use of broad-tired wheels has been their unwieldiness. The rim of the wheel coming so much nearer the bed of the wagon cramps it sooner in turning, and so requires more room. But if we diminish the diameter of the wheel to facilitate turning we increase the draft.

Numerous experiments proved that the difference in draft between high and medium wheels is not great, while between medium and low it is considerable.

The greater ease with which wagons with wheels of medium height can be turned and loaded and unloaded would more than counteract their increased draft over those with wheels of normal height.

Considering draft, convenience, etc., it is believed that the most suitable height for wheels of a farm wagon, especially with wide tires, is 32 to 36 inches in front and 36 to 42 inches in the rear.

REPORTS

OF

ALEXANDER CRAW,

HORTICULTURAL QUARANTINE OFFICER.

HORTICULTURAL QUARANTINE REPORTS.

By ALEXANDER CRAW,
State Horticultural Quarantine Officer.

To the Honorable the State Board of Horticulture:

Gentlemen: I herewith present to you my semi-annual report, including the summer months that are usually light in importations of nursery stock.

There have been received and inspected, however, 87 crates, cases, and bundles of trees and plants, besides 148 loose lots (numbering from one to eleven plants in each lot), 7,774 cases of citrus fruits (mostly limes), 1,593 crates of pineapples, and 1,668 packages of miscellaneous fruits.

The above list was found upon 132 steamships and sailing vessels, since my last report. I am present during the landing of passengers and the examination of their baggage. As heretofore, all trees, plants, and fruits infested with injurious insects or diseases new to the State have been destroyed.

Another mongoose was taken and killed on the 6th of June, and presented to the Academy of Sciences for its collection. On June 7th, a Los Angeles paper referred to the existence of a living mongoose in that city, in a Broadway store. I immediately wrote to Horticultural Commissioner J. W. Jeffrey, of Los Angeles, requesting him to take action under Section 6 of the Act of March 11, 1899, and see that the animal was destroyed. Mr. Jeffrey learned that it was brought into the State by rail from a Texas port and that it died soon after its arrival. Shortly afterward I received a letter from T. S. Palmer, Assistant Chief of the United States Biological Survey, Washington, D. C., inquiring as to what action had been taken in regard to this mongoose. I sent him the correspondence relating thereto.

On May 31st, we destroyed an importation of several thousand Japanese "song cricket" eggs. The importers claimed that they had a certificate from Dr. Stuart Eldridge, Assistant Surgeon, U. S. Marine Hospital Service, Yokohama, Japan, certifying that the insects were not injurious to plantations or fields, but the certificate was not produced. I wrote to Dr. Eldridge, and he sent me a copy of a letter he had forwarded at the time to the Collector of Customs at this port, showing that he had done all in his power to prevent harm from the importation in question. The following is a copy of Dr. Eldridge's letter:

> By steamship "Nippon Maru," leaving to-morrow, goes one parcel of the eggs of an insect upon the invoice of which I have placed the following indorsement:
>
> "The foregoing eggs are those of a species of cricket, called by the Japanese 'Kutsuwa-mushi,' which is kept by the natives in cages on account of its so-called musical cry. It is, of course, a vegetable feeder. In Japan it has never within my knowledge proved injurious; but, in view of the sad and unexpected results which, in some cases, have followed the introduction of exotic animals into fresh territory, I think it well to call attention to this shipment."

At various times heretofore we have destroyed living specimens of these crickets that came in fancy split bamboo cages from Japan. We have all the species of vegetable-eating crickets, katydids, and grasshoppers in the State that we care for. The song of the "Kutsuwa-mushi" would hardly compensate for the damage it would probably do.

Occasionally we find a few oranges in the possession of passengers from Mexico, which we confiscate and destroy. But no shipments of such fruits have been received from the maggot-infested districts since the destruction of the consignment received from Acapulco, Mexico, November 19, 1899, until Sunday, November 3d, of this year, when the steamship "Newport" arrived, and in her cargo were fifteen cases of oranges in which the maggots were present. I condemned the fruit and boxes and burned them.

I hope that Congress will take some action at the coming session, and pass a law that will prohibit the introduction of oranges from the infested sections. If a measure of this kind is not enacted, the growers of citrus fruits in the United States may soon have to wage war upon a pest that will be more difficult to control than the codling-moth in apples and pears.

I do not anticipate any satisfactory results from the Mexican Government's request to the Governors of the various States to have the pest stamped out of their districts. It is too serious a question for our Government to hesitate upon. From a personal interview with Secretary of Agriculture Wilson, I am satisfied that we can rely upon his hearty coöperation in preventing such a pest entering the United States.

Another perplexing question is the presence of the melon-cucumber maggot in Honolulu. Honolulu is now a domestic port, and the examination of baggage by customs inspectors has been discontinued, so that the pest may be brought in by thoughtless individuals bringing infested melons or cucumbers in their baggage. This pest is probably a native of Japan, as I have intercepted its coming from that country. It is not known to occur in the United States. As heretofore no products that would harbor this pest have been permitted to land. I hope your Honorable Board will advise me further as to what should be done to ward off that disgusting pest.

Last June a serious red currant pest, *Epochra canadensis*, was forwarded to me from Sebastopol, Sonoma County. This is the larva of a small fly. It enters the currant, causing it to shrink and decay. I advised the destruction, by burning, of all the currants, also the removal of the surface soil and its burial deep between the rows. This would get rid of any that had entered the soil to pupate. It can not be ascertained how this pest was introduced. Sonoma County, unfortunately, dispensed with its County Horticultural Commission a few years ago.

During the past summer, the Horticultural Commissioners of Tulare County stopped some ornamental plants at Lindsay which were from the East and which were infested with scale; samples were sent to me for determination. I found them to be the "Florida red scale" (*Aspidiotus ficus*), a pest of orange trees. This was a fortunate seizure, as Lindsay and Porterville are noted as early citrus districts.

The Commissioners of Los Angeles County recently found some ornamental plants from the East infested with the "Florida chaff scale" (*Parlatoria pergandei*), another citrus pest. The Commissioners of Riverside, San Bernardino, and several other counties, have lately found important pests on ornamental stock from Eastern States.

The Supervisors of several citrus-growing counties have strengthened the hands of their Horticultural Commissioners by passing ordinances against the introduction of citrus trees from States where the "white fly" (*Aleyrodes citri*) exists. This is a wise movement in the interests of their citizens.

On October 18th, the steamship "Australia" arrived from Tahiti, and a passenger had a package of vanilla stems, on which I found a single "red scale" (*Aspidiotus aurantii*). This shows the existence of that scale in Tahiti. Another scale from the same place was found infesting a package of Tradescantia plants, which I destroyed. This was *Icerya seychellarum*, a near relative of the "cottony cushion scale." It is smaller than the latter, and the back of the female is covered, or rather circled, with a double row of tufts of canary-colored cotton. Down the center of the back is a row of similar tufts. The egg sac is pure white.

From Australia came two orange trees infested with *Chionaspis citri*, the "orange snow scale"; also a holly bush with *Ceroplastis rusci*. All were destroyed.

From Mexico came plants infested with the following scale insects: *Parlatoria*, *Aulacaspis*, *Ceroplastis*, and *Asterolecanium*.

From Guatemala came palms infested with "red scale" (*Aspidiotus aurantii*).

From Japan, biotas with Tortrix larvæ feeding upon the foliage, and pine trees with "basket worms" (*Thyridopteryx*). The white circular scale (*Diaspis amygdali*) I again found upon tea plants from Japan.

This scale is a serious one wherever found upon peach, cherry, prune, and, in fact, upon nearly all deciduous fruit trees and a number of ornamental plants.

According to your instructions I visited Tehama County on June 3d and 4th and investigated the reported existence of the "olive-knot" (*Bacillus oleæ*) in several young orchards. With Mr. Harvey C. Stiles I visited a number of young olive orchards, and although we found indications of the disease there was no appearance of any virulent cases. This may have been owing to the fact that the trees had been planted within the year. It was the desire of a number of the orchardists to have the disease stamped out of the colony if possible, and as they anticipated some opposition on the part of non-resident owners, I submitted the matter to the Attorney General, to ascertain if the County Horticultural Commissioners or the State Board of Horticulture could take any action toward stamping the disease out of that and other counties where it had appeared. The opinion of the Attorney-General is given on pages 53 to 57, inclusive, of your bulletin, "Horticultural Statutes of California." It would appear that the County Horticultural Commissioners have power to abate such nuisances in their respective counties. There is nothing, however, in our statutes conferring such power upon the State Board of Horticulture. It is to be hoped that the County Horticultural Commissioners will see that the destructive olive disease is stamped out of the State.

On June 21st I was requested by District Attorney Gill, of Tehama County, to visit Red Bluff and testify regarding a shipment of fruit trees received from Oregon that were condemned and destroyed by Horticultural Inspectors R. W. Coats and A. W. Samson. The trial of the case had been proceeding for four days. Samples of the trees had been submitted to me by the Inspectors, and I had specimens of the root preserved in formalin, which I took with me, and they were introduced as exhibits in the case. Owing to the fact that the County Horticultural Commissioners had omitted to make application to your Board for Quarantine Guardian certificates for their Inspectors, the court decided that the Inspectors were not qualified to act as Quarantine Guardians, and decided the case against them. The trees, however, were adjudged to be of no commercial value, and the plaintiff was awarded damages, fixed at the nominal sum of one dollar.

It gives me pleasure to report to you the receipt of two packages of *Scutellista cyanea*, the South African internal parasite of the black scale; seventeen were alive upon arrival and were immediately placed in a breeding-case containing an oleander infested with black scale. One has since died, but the others appear to be active. The parasites were sent by Prof. Charles P. Lounsbury, Government Entomologist of Cape

Colony. The Cape Government is very anxious for California to have this valuable insect established here.

I am in receipt of a telegram from Dr. L. O. Howard, U. S. Entomologist, Washington, D. C., which reads: "Have at last got living *Erastria scitula* from Italy. Black scale enemy. Can you handle them to best advantage?" I wired him regarding the condition of our scale. Besides your own efforts to secure the natural enemies of this scale, it is encouraging to record the work of such men in behalf of our orchardists.

Dr. Howard has been conducting experiments with parasitical fungus from South Africa, for the destruction of grasshoppers. At my request, he has kindly forwarded tubes containing the fungus cultures to citizens of this State, with full instructions for establishing the disease. It is stated that the fungus will not affect human beings, domestic animals, or fowls.

On November 18th, Dr. Howard forwarded a colony of *Coccinella septempunctata* lady-birds that he had received from Europe; these lady-birds prey upon prune and other aphis. Upon their arrival I placed them in a breeding-jar with a piece of wet white silk. The lady-birds sipped some moisture from the silk and then clustered on the cover for the night. Next day they were given rose aphis, which they greedily devoured. As soon as the season comes around they will be placed in a prune orchard.

I have to report that the colonies of *Vedalia cardinalis* sent through the courtesy of your Board to Professor H. A. Gossard, of Lake City, Florida, and others in that State, have been wonderfully successful in checking the "cottony cushion scale" (*Icerya purchasi*). A comprehensive bulletin was issued by Mr. Gossard, giving a history of the unfortunate introduction of that pest into Florida, its spread through their orange groves, and of its subjugation by the *Vedalia*. We still keep up a stock of the four species of introduced lady-birds that prey upon this scale, viz.: *Vedalia cardinalis*, *Novius koebelei*, "*Black Vedalia*," and *Novius bellus*. The first two were introduced by Albert Koebele, and the other two by George Compere.

An outbreak of "cottony cushion scale" occurred in Guaymas, Mexico, and at the request of a citizen of Los Angeles a colony of *Vedalia* was sent to check this scale.

Hon. Teodoro Schneider, Commissioner of Chili to the Pan-American Exposition at Buffalo, visited this State at the request of his government, and we furnished him, through the kindness of William Barry, of Niles, with strong colonies of *Rhizobius toowombæ* and *Rhizobius ventralis*, which he took to Chili via New York.

In order to check the destructive introduced pests of the fruit trees, you have sent two experts to Australia, at different times, to find the natural enemies of these pests and to introduce them into California.

One of these pests that the experts were especially requested to give close attention to was the red scale (*Aspidiotus aurantii*). Australia and adjacent islands had been twice searched by Mr. Koebele and once by Mr. Compere. Several species of lady-birds that prey on this scale were collected and forwarded by them, but no true parasite was found in those countries. Mr. Compere was also directed by you to visit the Orient. At Hongkong he found evidences of internal parasites in the "red scale." He could find no suitable tree there to send to California, so, in spite of the "Boxer" trouble in China, he ventured into that country and succeeded in finding a small orange tree slightly infested, and on which he observed the small chalcid flies depositing their eggs in the scales. He purchased the tree, carefully dug and boxed it, and shipped it to San Francisco. In its native place the ground was overgrown with a dense crop of weeds that covered the stem for a foot or more. The portion so covered was badly infested with red scale, as they were protected from the parasites by the weeds. The tree arrived in San Francisco on November 21, 1900, and was placed in a glass breeding-case. The scales hatched on the base of the stem and soon infested the upper portion of the tree and leaves. I did not expect that any parasites would appear before June, as most of the internal scale parasites generally begin to issue about that time. On May 31st, six parasites appeared. None in June, 36 in July, 81 in August, 143 in September, and 381 in October, making a total of 647. These have been liberated in red scale infested orchards in Los Angeles and Orange counties. Owing to our removing the parasites as soon as they are developed, the scales are quite plentiful upon the imported tree. The parasites are hardly noticeable to the naked eye, as they are slightly smaller than *Aspidiotophagus citrinus*, the internal Japanese chalcid parasite of the "yellow scale," which has practically stamped that scale out of Los Angeles, Riverside, and San Bernardino counties. Professor Charles P. Lounsbury, of Cape Colony, is an enthusiastic believer in the value of beneficial insects, and on page 26 of his report as Government Entomologist for 1900, referring to the red scale, which is also a pest with them, he says: "The Californians have always believed that the scale originated in Australia, as they are confident that it reached their State from there, but now that they have had that land searched in vain for natural enemies, they may turn their attention to the south of Europe. We hope so." This is a fervent wish, but our little chalcid friend has come from the other side of the world. An encouraging feature of these parasites is the fact that they prefer the scales before they have reached the stage where they reproduce their kind.

With the exception of the "cottony cushion scale," internal parasites have been the means of subduing or keeping in check most of our serious introduced scale insect pests, among which may be mentioned the following: The "yellow," by *Aspidiotophagus citrinus;* the "soft brown," by *Coccophagus lecani* and *Encyrtus flavus;* the "brown apricot," by *Comys fusca;* the "San José," by *Aphelinus fuscipennis;* the "mealy bugs," out of doors, by *Rileyia splendens;* the "cottony grape scale," by *Encyrtus flavus.*

Let us hope that the Chinese parasite of the red scale will prove equally successful.

DECEMBER 6, 1900.

To the Honorable the State Board of Horticulture:

GENTLEMEN: I herewith submit my report for the months of December, 1900, to April, 1901, inclusive.

During this time we have found plants, trees, or fruit upon 95 steamships and sailing vessels from foreign countries and also from the Hawaiian and Philippine Islands.

The receipts consisted of 369 cases, boxes, and bales of trees and plants; 97 loose lots of plants, numbering from one to a dozen in each lot; 10,386 boxes of citrus fruits, principally limes and Japanese oranges; 2,848 boxes of miscellaneous fruits; 7,373 boxes of tomatoes from Mexico and Honolulu; 5,598 crates and sacks of onions from Australia.

The above were carefully examined, and when found infested with insects or diseases not already found in the State, were destroyed, and when necessary all other stock has been fumigated with hydrocyanic acid gas.

Four new steamship lines are running now between San Francisco and Central and South America, calling at the principal ports en route.

On April 5th, the steamship "Arequipa" arrived from Valparaiso via Mexican ports, and had two baskets of oranges as the ship's stores. These I found infested with Mexican orange maggots (*Trypeta ludens*), and burned them in the ship's furnace. The Pacific Steam Navigation Company's steamer, "Peru," arrived on April 29th from Chili via Acapulco, Mexico, and had a bin of oranges from the latter port for use on board ship. Upon inspection I found that they were also infested with orange maggots. The tables were set for breakfast and the fruit on them was Mexican oranges. These I removed and burned with the others. From the size of the maggots in this and former lots destroyed, I am convinced that there are at least three broods of the pest during the time that the crop of oranges remains upon the trees.

During the summer of 1897, Mr. Albert Koebele visited Mexico in search of beneficial insects for the Hawaiian Government. Before his departure I requested him to secure for me preserved specimens of orange maggots and flies. He visited the State of Morelos five different times, and it was only upon his last visit, about the middle of October, that he found any infested oranges. Since then I have been informed that the flies only deposit their eggs upon ripe fruit. We have found oranges containing maggots in the months of December, November, February, and April. Each time we have found them in various stages, indicating several broods. This would be a serious pest in California, for our "Valencia Late" oranges are sometimes allowed to remain upon the trees for early fall shipments. We are in receipt of a communication from the Honorable A. L. Herrera, Chief of the Comision de Parasitologia, of the Mexican Government, requesting literature and information upon this orange pest, as his government intends commencing an energetic warfare against it. Orange maggots are now found as far north as the city of Chihuahua, in the border State of the same name.

In former reports I have referred to the small white destructive scale, *Diaspis amygdali.* On April 25th, the steamship "Nippon Maru" arrived from Japan and had one bundle of one hundred two-year-old flowering cherry trees for planting in Golden Gate Park, San Francisco. The trees were infested with the above scale, so were burned.

The scarcity of peach stock for the past three years in this State has caused planters and others to purchase such trees in the States immediately east of the Rocky Mountains. The trees were supposed to be grown in those States, but subsequent reports show that they had been grown farther east. The stock all arrived by rail and has been dipped by the county officials. Thousands of peach trees have been burned by the commissioners when found infested with the "black aphis" (*Aphis persica niger*), but unfortunately some lots have been allowed to escape, and this pest has obtained a foothold in several counties. Nearly all shipments arriving from the Eastern and Southern States are accompanied by certificates of inspection, signed by an official of the agricultural college or experiment station in the respective States, stating that the trees have been examined and found to be free from injurious insects, etc. The inspectors have heretofore been instructed not to rely upon such certificates, because of the fact that nearly all inspection work in the Eastern and Southern States is done during the summer time, when the condition of the roots can not be ascertained. The above aphis also infests the roots of peach trees.

The danger of introducing the "white fly" (*Aleyrodes citri*) that has caused so much damage to citrus trees in Florida, really demands that some effective way of preventing its introduction into California be considered. Probably the most effective check for the present would be for the Supervisors of the various citrus-fruit-growing counties to adopt Riverside County's plan of passing an ordinance prohibiting the bringing of citrus trees from Florida. The danger of introducing this pest is greater than it is with the scale insects. In the early stages of their existence the *Aleyrodes* resemble scales, but they differ in the fact that the females are winged as well as the males. In a letter from a correspondent in Chili, he states that this pest has lately appeared in some of the orange trees of that country and is causing alarm. In writing about the "purple scale" (*Mytilaspis citricola*), he says: "This parasite has destroyed the greater part of the orange trees of the coast valleys of Chili," and adds: "The pecuniary loss to this country through the destruction of the orange trees is very great. To extirpate this pest every class of remedy has been tried, but with no effect so far."

On February 27th Professor Charles P. Lounsbury, Government Entomologist of Cape of Good Hope, South Africa, sent me a box of twigs and branches of myoporum and oleander, slightly infested with "black scale" (*Lecanium oleæ*), the box coming by way of England. From Cape Town it was sent in the cool chamber of the steamer to London, and from there to San Francisco by express. All charges were generously paid by the Cape Government. There was a most unfortunate delay when the box reached New York, as it was detained by the customs officials for invoice. On April 9th I received notice of its detention, and immediately telegraphed the facts to Dr. L O. Howard at Washington. He telegraphed the Government Dispatch Agent at New York, who had them promptly released and forwarded. Unfortunately, however, the box must have gone astray, for it did not reach me until April 23d. In consequence, all the myoporum was dried up and the scales dead. The oleander material was in a slightly better condition, and at this writing three of the chalcid parasites (*Aphycus lounsburyi*) have issued. This parasite appears to attack the half-grown "black scale."

On April 15th, at the request of Dr. Howard, a colony of *Vedalia cardinalis* was forwarded to Dr. Antonio Berlese, Scuola Superiore di Agricoltura, Portici, Italy, to check an outbreak of "cottony cushion scale" (*Icerya purchasi*) in that country.

In my report to you dated November 11, 1897, and published on page 102 of your Preliminary Report (Sixth Biennial), I referred to the sending of two colonies of lady-birds (*Vedalia cardinalis*) from this office, that checked the same scale in Portugal. This was also done at the request of the Department of Agriculture, Washington, D. C. We now have great difficulty in securing "cottony cushion scale" to feed our breeding colonies of the four species of lady-birds that prey upon that scale. Numerous applications have been received and the insects supplied, but in nearly every case very few scales were found. A year ago several serious outbreaks of this scale occurred in different counties, but these were soon checked by colonies of lady-birds sent from our breeding-jars.

I am pleased to report that the internal parasite, *Comys fusca*, has been successfully established in Tulare County upon the "brown apricot scale" (*Lecanium armeniacum*). This scale has caused alarm, especially among the prune-growers, owing to the great amount of honey-dew thrown off by the scales, and the subsequent growth of black smut injuring the growth of the trees and the quality of the fruit. Two years ago, and last year also, colonies were sent to prune-growers in the San Joaquin Valley. Among others, George A. Fleming, of Visalia, received a colony. I am just now in receipt of a box of scale-infested twigs from his orchard. The *Comys* are now issuing from the scales. A careful examination shows that fully ninety per cent contain parasites. This is at least fifteen days earlier than they hatch in Santa Clara and Alameda counties. George H. Cutter, County Horticultural Commissioner of Sacramento, has the *Comys* well established in his orchard, and is now placing them in other orchards in his county. The flies are now hatching from the scales sent to me by him. The scales that are parasitized produce no eggs, and are slightly smaller and of a darker color than the healthy scale at this time of the year. The female deposits a single egg in each scale about the time that the scales are three-fourths grown. The egg hatches into a small, blind, footless grub, destroying the scale and changing into the chrysalis under the scale. The winged parasite then cuts a hole through the top of the scale and makes its escape. If the orchardists who have received colonies of *Comys fusca* within the past two years will make an examination of the scales with a pocket lens, they will notice the exit holes in the scales if the parasites have established themselves.

Per the steamship "Sierra" that arrived February 10th, and the steamship Sonoma, March 18th, we received from George Compere two fine consignments of "red spider lady-bird" (*Scymnus vagans*), which he had collected in Australia. Mr. Compere writes in the highest terms regarding this minute lady-bird. Strong colonies have been sent to Alameda, Colusa, Fresno, Merced, Los Angeles, Santa Barbara, San Diego, Santa Clara, Contra Costa, Sacramento, and Yolo counties.

We have received no more internal parasites of the half-grown black scale (*Myiocnema comperei*, Ashmead), as Mr. Compere was unable to again visit Brisbane, Queensland. In a letter from Mr. Compere, dated Sydney, February 26, 1901, he writes: "Since writing you last I made a trip to West Maitland, and on the way I remained over two days at Newcastle, there being plenty of oleander trees there and plenty of olive trees at Maitland. I expected to have no difficulty in finding 'black scale,' but was mistaken, for at both places the same condition prevailed as at Merickville, with the same parasites present, and hand picking of the scales was the best that I could do."

In another letter dated March 26, 1901, he writes: "The parasites on the eggs of the black scale are in many respects the same as our *Dilophogaster*, but I think are going to be more effective. I found a plant from which I picked thirty-eight scales, every one on it, and each contained a maggot."

Those parasites reached us in good condition and have been developing from that and subsequent sendings, so that we have been enabled to send colonies into districts where conditions are suitable for their successful colonization. Specimens were sent to Dr. L. O. Howard. It was found to be a new species, and on the suggestion of Dr. Howard, Mr. Ashmead named it *Hemencyrtus crawii*, Ashm. Ten colonies were sent to Santa Clara County and liberated upon black scale; seven colonies to Los Angeles County; two colonies to Santa Barbara; two to Alameda; two to Ventura; one each to San Diego and Monterey counties. Mr. Compere has also forwarded two new species of internal parasites of aphis that arrived in good condition and were liberated in Alameda and Santa Clara counties, as these counties were convenient and delay would have proved disastrous to such small insects.

On Sunday, February 10th, the steamship "Sierra" arrived from Australia, and had in the cold-storage room a box of dead grasshoppers containing chrysalis of the internal dipterous parasite, *Homolomyia canicularis*, collected in Australia by Mr. Compere. The box was again placed in cold storage in this city in a room where the temperature is kept at from 35° to 40°, and will remain there until June, when our grasshoppers are plentiful. We will then place the dead hoppers in a slightly warmer temperature so that the flies will develop, when we will liberate them in various districts of the State where grasshoppers are destructive. Two more boxes arrived on Sunday, February 24th, per steamship "Alameda," and were placed in cold storage with the others.

It was impossible for me to again visit Livermore Valley, after liberating fifty-nine healthy parasites on the 14th of last June, and referred to on pages 66 and 67 of your Seventh Biennial Report. The conditions were very favorable at that time, so I hope the parasites got a start.

May 15, 1901.

To the Honorable the State Board of Horticulture:

Gentlemen: I herewith present a synopsis of my semi-annual report as Horticultural Quarantine Officer and Entomologist.

Since my last report 105 steamships and sailing vessels have entered the port of San Francisco having trees, plants, or fruit on board from the following countries: China, Japan, Australia, New Zealand, Pacific and South Sea Islands, Mexico, Central and South America, and Philippine Islands.

As formerly, the greatest number of trees and plants came from Japan. The imports from all parts by sea consisted of 789 cases, boxes, bundles, and loose lots, and 6,855 cases and boxes of miscellaneous fruits. As heretofore, no plants that were even slightly infested with insects new to the State have been permitted to pass ashore.

I desire to call attention to the great development of the trade in fresh tomatoes between Mexico and the United States during winter and spring, and to the possibility of portions of California supplying the demand. We have districts that are practically exempt from frost, and if tomato plants were well established with half-grown tomatoes before cold weather and then slightly protected, the tomatoes would mature during the winter and spring, when prices are high. Nearly 13,000 twenty-pound boxes came in this season that averaged $2.50 per box.

We occasionally find a melon in the possession of passengers or crews from Honolulu, which we destroy. No melons, cucumbers, or summer squash have been received as freight from Honolulu since we destroyed the shipment that arrived on February 28, 1899, on the steamship "Australia," infested with the melon maggots (*Dacus cucurbitæ*). In Honolulu this pest destroys seventy-five per cent of their crop. It is not found in North America.

The steamship "Tucapel" arrived on December 19th from South American ports via Acapulco, Mexico. In her stores I found some Mexican oranges, and in the presence of Captain Moffatt I cut several apparently sound oranges and found them infested with the Mexican orange maggot (*Trypeta ludens*). The captain declared he would never purchase or again eat a Mexican orange.

On March 19th, the steamship "City of Para" arrived from Central American and Mexican ports. A passenger had a basket of "sweet limes" that were infested with orange maggots, and the fruit was immediately burned. This pest never attacks any sour fruit, such as lemons or limes.

I learned more regarding the fifteen cases of oranges that arrived from Acapulco per steamship "Palena" on Sunday, November 24, 1901. The fruit was cremated, as it was infested with orange maggots. On a subsequent steamer the owner and shipper of the oranges arrived, and informed me that he had the oranges carefully picked and inspected two weeks before shipping. Before packing, the fruit was again inspected and he thought it entirely free from maggots. He went to all that care and trouble, as he intended, if that lot was successful, to go extensively into the shipment of early oranges.

In January the U. S. A. transport "Kilpatrick" arrived from Manila. An army contract physician, J. B. Hallwood, brought a mongoose as a pet. After a great deal of technical opposition and appeal on his part to Collector of Customs F. S. Stratton, and the Department of Agriculture, Washington, D. C., I was sustained, and finally chloroformed the animal.

A somewhat unique importation arrived on the steamship "America Maru" on December 27, 1901, from Japan. It was a willow tree twelve feet high and branched in proportion to height. It was intended as a New Year or Christmas tree, for the Japanese community. As it was infested with a new species of *Chionaspis* scale insect, it got no further than the dock.

On April 24th, a large hibiscus was brought in on the steamship "Argyle" from Panama; it was covered with a new *Chionaspis*, and it was also destroyed.

On December 29, 1901, the steamship "San José" arrived. A passenger had a gardenia from San Blas, Mexico, infested with "mining scale" (*Howardia biclavis*), and it was destroyed.

From coniferous trees imported from Japan we breed "saw flies" and Tortrix moths. The larvæ of the former were destroying the leaves of pine trees, and the caterpillars of the latter were feeding on the foliage of biotas. I submitted the specimens to Dr. L. O. Howard, of Washington, D. C., and in reply he wrote: "The saw-flies have been examined by Mr. Ashmead, who states that they belong to the genus *Monoctenus;* but no specimen of this genus has been recorded from Japan, unless Konow has described some since Dalla Torres catalogue was published two or three years ago. Your specimens are different from anything in the National Museum collection. The Tortricid moths are unnamed."

Last year I was informed by one of the large almond-growers that a number of his almonds were damaged by worms eating into the nuts. At the time he could not find any of the insects. I requested him to keep watch of the trees this spring when the nuts were set. On April 26th, he sent me a package of those he saw were attacked. Upon examination, I found the worms to be the larvæ of the old time "peach-twig borer" (*Anarsia lineatella*). To prevent any damage by this moth, the orchard should be sprayed, before the trees start in the spring, with a solution that will penetrate the burrows of the small larvæ that work in the spongy bark during winter. A wash of lime, sulphur, and salt is preferable, as it is also a good check to the red "clover mite" (*Bryobia pratensis*) and leaf fungus.

On April 15, 1901, at the request of Dr. L. O. Howard, I sent a colony of thirty-six larvæ of *Vedalia cardinalis* to Dr. Antonio Berlese, Scuola Superiore di Agricoltura, Portici, Italy. In less than a year this sending exterminated the "cottony cushion scale" that was established there.

At the request of Mr. Lionel Hanlon, of Auckland, New Zealand, I sent him about two thousand of our native aphis-feeding lady-birds, *Hippodamis convergens*. In a letter Mr. Hanlon informed me that the beetles reached him in splendid condition; they were collected and packed at Mountain View, by Edw. M. Ehrhorn.

The Hungarian lady-birds, *Coccinella septempunctata*, received from Dr. Howard, increased and were liberated on prune aphis in Santa Clara and Alameda counties. Part of the second generation is now depositing eggs in the breeding-jars in the office.

The Italian moth cocoons, *Erastria scitula*, and enemy of the "black scale," received by Dr. Howard from Italy and sent to us for propagation, developed and were sent to Los Angeles, Alameda, and Santa Clara counties. While they are not as rapid breeders as the South African parasite, *Scutellista cyanea*, still all help to reduce the numbers of that scale pest of citrus, olive, and apricot orchards.

I am pleased to report the successful propagation of the seventeen *Scutellista cyanea* received from Prof. Charles P. Lounsbury, Government Entomologist of Cape Town, on October 31, 1901. Four were females; but unfortunately one was killed by a small spider concealed in a curled leaf. This left us but three females to undertake the colonization of this valuable insect in the extensive orchards of California. We have been so far successful that two generations of California-bred *Scutellista* have been liberated and we are now breeding the third generation indoors. As the climate of San Francisco is not as favorable for this work as is that of the fruit-growing counties, I believe we could have had at least another generation in the same time. This is a most encouraging feature in the life history of this insect, as our native internal parasite (*Tomocera californica*) has but one generation a year and never more than seventy-five per cent of the scales are destroyed by it, leaving twenty-five per cent of the scales alive, each containing from 1,500 to 2,000 eggs. On one of the trees colonized with *Scutellista* not a scale escaped to bring forth its young. In South Africa it is difficult to find "black scale," owing to this parasite. Colonies of *Scutellista* have been placed in orchards in Alameda, Santa Clara, San Diego, and Santa Barbara counties, as the conditions in each were considered most suitable to establish breeding centers.

Regarding the internal parasite (*Comys fusca*) of the "brown apricot scale" (*Lecanium armeniacum*), we have received very encouraging letters from growers where this parasite was placed two and three years ago. The prune, apricot, and other trees that formerly were covered with this scale and black fungus are now clean and bright. We sent out thousands of *Comys* in June, through the central, coast, and bay counties, where this scale has been troublesome.

It has been like trusting in a miracle for some growers to abandon all artificial methods and rely upon a few dozen tiny parasites sent to each applicant to clean up the scale. Owing to climatic conditions this season, the *Comys* was about three weeks late in developing to the winged form.

Rhizobius ventralis, the Australian "black lady-bird," is working into favor in some districts where it formerly appeared to be a failure. In the San José and Mountain View districts, Edw. M. Ehrhorn, the Horticultural Commissioner, gives the *Rhizobius* full credit for having cleaned up several orchards of "black scale" (*Lecanium oleæ*). On a recent visit I found the lady-birds were still present in small numbers and the scale very scarce. In a letter from John Scott, of Duarte, Los Angeles County, dated June 30, 1902, referring to this lady-bird, he writes: "You must know that although I never anticipated the great things from the *Rhizobius* that you and the State Board did, I always had hopes that if a supply was constantly kept up in one district they would eventually become acclimated and be of good service. On these lines I have quietly worked and have placed colonies in the same trees every year, some years as many as five colonies. Up to this year I have never been able to find a single beetle after a few days. Now I am pleased to be able to say that I can find larvæ and mature lady-birds in every tree on my place where 'black scale' is to be found. I don't want to be too sanguine, but I *do* think they will clean me up this year. Knowing your interest in these matters I thought these facts might interest you."

Mr. Scott was for five years Horticultural Commissioner of Los Angeles County, and well knows the tenacity of the "black scale," and the expensive battles he and other orange, lemon, and olive growers have waged against that pest.

The "black scale," like some other of our orchard pests, is an imported species, and but few of our native beneficial insects make much headway against it. Your policy of introducing and fostering all insects that prey upon it, is unquestionably the proper course, and it looks as if relief is at hand in the near future.

JUNE 30, 1902.

To the Honorable the State Board of Horticulture:

GENTLEMEN: As usual, during the summer months, the number of vessels arriving in the port of San Francisco from foreign ports, having plants on board, has been light. But eighty-one steamers and sailing vessels were found to contain such stock since my last report. A very marked improvement was noticeable in the character and cleanliness of the trees, plants, and fruits that have been received. This would indicate a more wholesome regard for our State laws and the regulations of your Board relating to such imports.

One hundred and ninety-six cases, boxes, bundles, and loose lots of trees and plants, and six thousand three hundred and twenty-eight crates and boxes of fruits were received. As heretofore, no plants or fruit showing even slight infestation with insects new to the State have been permitted to enter.

The stewards and other employés upon vessels trading between San Francisco and Acapulco and other Mexican ports have been notified not to bring any oranges or sweet limes. All such fruits found in the baggage or possession of passengers from there is confiscated and destroyed, to guard against the introduction of the disgusting Mexican orange maggot.

Early in November, some interested individuals caused to be telegraphed throughout the United States statements that the Mexican oranges are now free from infection by maggots, and in proof thereof stated that Californians had raised the embargo and that carloads of Mexican oranges had been shipped direct to California. No such shipments had come under my observation, but in order to ascertain positively if any had been received or brought into the State, I called upon the head traffic agents of the Southern Pacific Company and was assured that no oranges had or would be accepted by their agents; in fact, no rates upon oranges between Californian and Mexican points had been made, as they could not afford to jeopardize this important California industry. Cars that have been used in hauling Mexican oranges to the Eastern States, they informed me, are treated with live steam as soon as the cars are unloaded, so as to kill any maggots or pupæ that may be therein. This was also done last year in compliance with a request made by your Board.

We still have the valuable assistance of the customs officers in preventing the surreptitious landing of plants and fruit. This is of incalculable benefit, not only to California, but also to the entire United States. We are also notified of the arrival of plants by rail, and also by mail from foreign countries and our island possessions.

When in Orange County last August, I found an extensive nursery of small *trifoliata* orange trees, that had been purchased in Florida. The ground had just been irrigated, so was wet and muddy and in bad condition to make an inspection of the trees. The importation of citrus trees from Florida is attended with very great risk of introducing the destructive "white fly" (*Aleyrodes citri*). Official information regarding this pest in that State is as follows: "White fly is so generally distributed as to render restriction measures impractical." I requested County Horticultural Commissioner Nebelung to make a careful monthly tree-to-tree inspection of that nursery. Not a single citrus tree should be brought from Florida, or adjoining States, while there is danger from that filthy pest.

In my last report I referred to the successful importation of the South African black scale parasite, *Scutellista cyanea*. It has increased beyond our most sanguine expectations and is doing splendidly where it has been liberated in orchards. I have referred to this parasite more fully in a paper, "Parasitic and Predaceous Insects in the Orchards," to be read at the Twenty-seventh Fruit-Growers' Convention. The most desirable season to widely distribute this parasite of the black scale would be in the months of April, May, and June. To accomplish this, it will be necessary to have a larger insectory for breeding purposes. It is more satisfactory to have them under daily observation, so that they can be forwarded to the orchardists as soon as they develop.

At the request of the United States Department of Agriculture, we have sent colonies of *Vedalia cardinalis* to Bermuda, British West Indies, and to Tahiti, Society Islands.

Since our last report we have sent out colonies of the following parasites and beneficial insects: *Vedalia cardinalis*, "*Black vedalia*," *Novius koebelei*, *Novius bellus*, *Rhizobius ventralis*, *Coccinella septempunctata*, *Comys fusca*, *Coccophagus lecani*, *Aspidiotophagus citrinus*, *Encyrtus flavus*, and other more common species.

I am sorry to report that on my visit to Anaheim, I found all the orange trees had been cut down where the greatest number of the Chinese parasite for the "red scale" were liberated. This was a most unfortunate affair, as the trees were in a good neighborhood for such an experiment, and I was assured that they would be allowed to remain, to thoroughly test them. Fortunately, several smaller colonies were placed in other orchards.

Early in September, Dr. W. B. Wall, the well-known orange-grower of Santa Ana, sent me parasites he had bred from red scale. Upon an examination, I found them to be the "golden chalcid fly," referred to on page 221 of your report for 1891. Dr. Wall states that they are very numerous and are reducing the red scale. Roy K. Bishop, of Orange, and others, write favorably regarding it. This parasite was formerly found only in districts where the "yellow scale" (*Aspidiotus citrinus*) prevailed. Other growers have written favorably concerning this parasite.

To guard against the introduction of asparagus rust, you passed a resolution prohibiting the importation of asparagus seeds or plants into the State. Unfortunately, the disease has obtained a lodgment in several of the southern counties, from seed purchased in the Eastern States. It is but six years ago since it was first introduced into the United States. Every effort is being taken by the County Horticultural Commissioners to have it stamped out. Unless this is thoroughly done, it will be a serious blow to asparagus culture in California. No remedy is known for this disease, and the safest way to stop its further spread is to cover the plants with combustible material and burn them.

In my annual visit through the southern counties last August more than usual interest was taken in methods to check red spider and other mites, as fumigation and sprays have not been altogether satisfactory in citrus orchards. During the summer, I had an orange tree in a glass case for propagating scale parasites, but, notwithstanding the fact that the tree was sprayed every day with clear water, the red spider increased and damaged the tree by eating the chlorophyl of the leaves. I was afraid to use the usual remedies for spider, on account of the parasites, but either the spiders or the tree had to go. I gave the latter a thorough dusting with powdered sulphur, and two days afterward not a spider was to be seen, and the tree has remained clean since. The astonishing and encouraging feature of the case is the fact that the treatment has not, in the slightest, interfered with the propagation of the parasites, as they have gone on breeding regularly. Your Board has always strongly advised the free use of sulphur in deciduous orchards and vineyards, but our orange and lemon growers can also use it to great advantage. The increase of the spider, under conditions that have always been considered disastrous to them, is hardly credible. The construction of the case was such that the spray could only be applied from above, still that is the direction that the rain strikes the trees; besides, the humidity remained in the case all night.

Correspondence and inquiry relating to insects and horticultural matters have been extensive.

Respectfully submitted.

ALEXANDER CRAW,
Quarantine Officer and Entomologist,
State Board of Horticulture.

NOVEMBER 29, 1902.

COUNTY HORTICULTURAL COMMISSIONERS AND LOCAL INSPECTORS.

ALAMEDA COUNTY—	
A. D. Pryal, chairman	Temescal.
Wm. Barry, secretary	Niles.
E. O. Webb	Haywards.
BUTTE COUNTY—	
Colonel C. C. Royce, chairman	Chico.
Geo. F. Ditzler, secretary	Biggs.
P. R. Persons	Oroville.
CONTRA COSTA COUNTY—	
W. J. Westlake, chairman	Martinez.
Amos M. Graves, secretary	Antioch.
J. F. Busey	Concord.
FRESNO COUNTY—	
J. E. Mitchell, chairman	Sanger.
W. D. Weaver, secretary	Fresno.
W. M. Scott	Fresno.
HUMBOLDT COUNTY—	
G. E. Stewart, chairman	Rohnerville.
J. E. Jannsen, secretary	Eureka.
D. D. Averill	Arcata.
Inspector:	
C. W. Hutchins	Eureka.
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James A. Hill, chairman and secretary	Hanford.
J. E. Tilton	Armona.
H. W. Byron	Lemoore.
LAKE COUNTY—	
S. Graham	Lower Lake.
LASSEN COUNTY—	
I. N. Jones, chairman	Susanville.
G. W. Meylert, secretary	Janesville.
George Bean	Bieber.
Inspector:	
F. J. Winchel	Janesville.

LOS ANGELES COUNTY—

O. R. W. Robinson, chairman	Los Angeles.
J. W. Jeffrey, secretary	Azusa.
S. Strong	Norwalk.
Inspectors:	
Andrew T. Garey	City of Los Angeles and county at large.
Geo. W. Frazier	City of Los Angeles and county at large.
Wm. H. Payne	Monrovia.
Chas. L. Northcraft	Pomona.
Chas. A. Day	Pasadena.
A. M. Seeley	Covina.
Geo. W. Taylor	Downey.
Fred K. Maskew	Long Beach.
J. A. Barrows	Los Angeles.

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Return Roberts, chairman	Madera.
C. M. Petty, secretary	Madera.
W. M. Hughes	Madera.

MENDOCINO COUNTY—

T. J. Fine, chairman	Ukiah.
E. T. Swortfiguer, secretary	Willits.
J. R. Banks	Hopland.

MERCED COUNTY—

N. H. Wilson, chairman	Merced.
J. M. Davis, secretary	Atwater.
J. L. McClelland	Los Baños.

MONTEREY COUNTY—

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D. W. Rohrback, secretary	Dunbarton.
J. B. Sayler	Pleyto.

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A. D. Bishop, secretary	Orange.
M. Nebelung	Anaheim.

PLACER COUNTY—

J. B. Sisby, chairman	Penryn.
John Adams, secretary	Auburn.
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RIVERSIDE COUNTY—

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W. F. Budlong, secretary	Perris.
H. H. Holmes	Corona.

Inspectors:

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W. B. Hunter	Riverside.
R. A. Condee	Riverside.
P. A. Gunsolus	Riverside.
P. B. Stephenson	Riverside.
L. M. Cundiff	Riverside.
J. J. Kelly	Corona.
J. E. Elmore	Corona.
Wm. C. McIntire	Arlington.
E. G. Tuthill	Arlington.
H. A. Clark	San Jacinto.
A. G. Hull	Winchester.
E. W. Slygh	Armada.
T. S. Painter	Elsinore.
J. H. Clewett	Elsinore.

SACRAMENTO COUNTY—

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Geo. H. Cutter, secretary	Sacramento.
F. M. Grimshaw	Cosumnes.

Inspectors:

R. S. Currier	Folsom.
Jesse Aiken	Sacramento.
Ralph Murphy	Cosumnes.
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R. T. Curtis, secretary	Bryn Mawr.
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San Joaquin County—

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Inspectors:	
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T. N. Snow, secretary	Santa Barbara.
Joseph Dimmick	

Santa Clara County—

Ed. M. Ehrhorn, county entomologist	Mountain View.

Santa Cruz County—

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C. H. Rodgers	Watsonville.
Inspectors:	
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J. L. Curtis	Watsonville.
A. N. Judd	Watsonville.
H. C. Peckham	Watsonville.
L. P. Lauritzen	Watsonville.
Charles Spreckelson	Soquel.
Marcus Fidel	Skyland.

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G. A. Lamiman, secretary	Olinda.
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W. F. Wheeler, chairman	Oakdale.
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J. N. Stuhr	Newman.

Sutter County—

R. Kells, chairman	Yuba City.
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T. B. Hull	Tudor.

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T. H. Ramsey, chairman	Vina.
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R. W. Coats	Red Bluff.

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C. S. Riley, secretary	Visalia.
S. A. Baggs	Visalia.

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J. F. McIntyre, secretary	Ventura.
J. B. Alvord	Oxnard.

Inspectors:

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J. W. Graham	Saticoy.
I. W. Wolf	Nordhoff.
F. C. Foster	Santa Paula.
C. C. Elkins	Fillmore.
Walter H. Fleet	Piru City.
Clarence Binns	Simi.

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J. C. Campbell, chairman	Winters.
J. W. Anderson, secretary	Davisville.
T. D. Morrin	Rumsey.

Yuba County—

W. B. Meek, chairman	Camptonville.
Geo. W. Harney, secretary	Marysville.
John King	Wheatland.

CALIFORNIA HORTICULTURAL QUARANTINE GUARDIANS.

ALAMEDA COUNTY—

William Barry, Niles, and Alameda County at large.
W. O. Webb, Haywards, and Alameda County at large.
A. D. Pryal, Temescal, and Alameda County at large.

BUTTE COUNTY—

George B. Springer, Butte County at large.
George F. Ditzler, Butte County at large.

CONTRA COSTA COUNTY—

W. J. Westlake, Martinez, and Contra Costa County at large.

FRESNO COUNTY—

J. E. Mitchell, Sanger, and Fresno County at large.
W. M. Scott, Fresno, and Fresno County at large.
W. D. Weaver, Fresno, and Fresno County at large.

HUMBOLDT COUNTY—

R. W. Hutchins, Humboldt County at large.

KINGS COUNTY—

H. W. Byron, Lemoore, and Kings County at large.
James A. Hill, Hanford, and Kings County at large.
J. E. Tilton, Armona, and Kings County at large.

LAKE COUNTY—

S. Graham, Lake County at large.

LASSEN COUNTY—

F. J. Winchel, Lassen County at large.

LOS ANGELES COUNTY—

O. R. W. Robinson, Los Angeles, and Los Angeles County at large.
J. W. Jeffrey, Azusa, and Los Angeles County at large.
S. Strong, Norwalk, and Los Angeles County at large.
Andrew T. Garey, City of Los Angeles, and Los Angeles County at large.
George W. Frazier, City of Los Angeles, and Los Angeles County at large.
William H. Payne, Monrovia, and Los Angeles County at large.
Charles L. Northcraft, Pomona, and Los Angeles County at large.
Charles A. Day, Pasadena, and Los Angeles County at large.
W. B. Owens, Glendora, and Los Angeles County at large.
George W. Taylor, Downey, and Los Angeles County at large.

MADERA COUNTY—

C. M. Petty, Madera, and Madera County at large.

MENDOCINO COUNTY—

J. R. Banks, Mendocino County at large.

MERCED COUNTY—

N. H. Wilson, Merced County at large.

MONTEREY COUNTY—

D. W. Rohrback, Monterey County at large.

ORANGE COUNTY—

I. N. Rafferty, Santa Ana, and Orange County at large.
A. D. Bishop, Orange, and Orange County at large.
M. Nebelung, Anaheim, and Orange County at large.

PLACER COUNTY—

John Adams, Placer County at large.

RIVERSIDE COUNTY—

R. P. Cundiff, Riverside County at large.
W. F. Budlong, Riverside County at large.
H. H. Holmes, Riverside County at large.

SACRAMENTO COUNTY—

George H. Cutter, Sacramento County at large.

SAN DIEGO COUNTY—

Chester Gunn, San Diego County at large.
George P. Hall, San Diego County at large.
F. Austin, San Diego County at large.

SAN BERNARDINO COUNTY—
Robert Bosworth, San Bernardino County at large.
R. T. Curtis, San Bernardino County at large.
J. S. Fink, San Bernardino County at large.

SAN JOAQUIN COUNTY—
R. S. Davis, San Joaquin County at large.

SANTA BARBARA COUNTY—
T. N. Snow, Santa Barbara County at large.

SANTA CLARA COUNTY—
Ed. M. Ehrhorn, Santa Clara County at large.

SANTA CRUZ COUNTY—
J. H. B. Pilkington, Santa Cruz, and Santa Cruz County at large.
F. W. Hitchings, Corralitos, and Santa Cruz County at large.
C. H. Rodgers, Watsonville, and Santa Cruz County at large.

SHASTA COUNTY—
G. A. Lamiman, Shasta County at large.

STANISLAUS COUNTY—
J. N. Stuhr, Stanislaus County at large.

SUTTER COUNTY—
H. P. Stabler, Sutter County at large.

TEHAMA COUNTY—
A. W. Samson, Corning, and Tehama County at large.

TULARE COUNTY—
P. D. Fowler, Tulare County at large.
C. S. Riley, Tulare County at large.
S. A. Baggs, Tulare County at large.

VENTURA COUNTY—
J. F. McIntyre, Ventura County at large.

YOLO COUNTY—
J. W. Anderson, Yolo County at large.

YUBA COUNTY—
G. W. Harney, Yuba County at large.

REPORTS

OF

COUNTY BOARDS OF HORTICULTURAL COMMISSIONERS.

REPORTS OF COUNTY HORTICULTURAL COMMISSIONERS.

ALAMEDA COUNTY.

To the Honorable the State Board of Horticulture:

Gentlemen: I herewith respectfully submit my annual report as Horticultural Commissioner of Alameda County for the year ending October 1, 1902.

The season for the handling of nursery stock commenced November 18, 1901, and continued until May, 1902. The absence of insect pests has been remarkable. Thousands of young olive trees can now be seen at the California nursery, bright and clean, whereas two years ago they were black with smut; this has been brought about by the effective work of that valuable insect, *Rhizobius ventralis*, assisted by the internal parasite, *Dilophogaster californica*. The brown apricot scale (*Lecanium armeniacum*) has been nearly cleaned out of the orchards by the internal parasite, *Comys fusca*.

There has not been any spraying in this district since 1893, as we have depended entirely on the natural enemies of the different scales, as above.

The output of nursery stock has been up to the average, while that of ornamental stock has been far above the average, and the handling thereof has been much more satisfactory on account of their cleanliness.

Last May I received from Mr. Craw, State Quarantine Officer, a few colonies of *Scutellista cyanea*, the South African internal parasite of the black scale, and have succeeded in establishing them in the olive and orange grove of H. A. Mayhew at Niles. On September 18th I cut a few twigs of the olive and orange, and up to date, out of four small jars, have succeeded in hatching out fifty-three, showing a very gratifying result.

The fruit crop of all varieties has been abundant, but prices have ruled low, especially for peaches. Many of the orchardists have concluded to get rid of their peach trees, as the returns have been far from satisfactory.

Again, I am sorry to have to report the presence of the disease, *Monilia fructigena*. The loss this year in apricots, especially in Moorpark, in this part of Alameda County from this cause will foot up nearly one hundred and fifty tons. The earlier varieties seem to escape the disease to a certain extent. I see by written reports that it has also appeared in Santa Cruz County.

Respectfully submitted.

WILLIAM BARRY,
Commissioner.

CONTRA COSTA COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: In the central district of Contra Costa County the conditions, so far as the growing of fruit is concerned, are fairly good, considering that the rainfall for the last four years has been short of the usual quantity. This has been largely, but not entirely, compensated for by increased attention to thorough cultivation, and, in a few instances, to winter and early spring irrigation from the mountain streams which flow into our valleys.

Good work is being done by the orchardists in the way of spraying to lessen the ravages of the codling-moth in apple and pear orchards, and when properly done by experienced men, a large degree of success rewards their efforts.

Black scale is not as numerous as it was a year or two ago. This is partly due to spraying with kerosene emulsion, and partly, I think, to the thousands of robins that feast on the scale during the winter months when the snow on the mountains forces them to come down into the valleys to secure food.

For the red spider on the almond trees we have tried spraying with the salt, sulphur, and lime mixture; also with caustic soda, made so strong as to kill the small twigs; both were used in winter when the trees were dormant, and both proved failures, so far as eradication is concerned. The number of mites was reduced so little as to leave doubt as to whether the benefit was worth the expense.

We next tried the application of dry sulphur in midsummer, giving the trees three separate dustings, at intervals of two weeks. This, we think, has done some good, but how much we shall not know until next spring.

In the matter of phylloxera, there are some isolated cases in this district. In such cases the destruction of all affected vines and the planting of resistant stock are urged.

In the eastern district of Contra Costa County the conditions, so far this season, have been good for the fruit-growers, considering the scarcity of rain; but by constantly cultivating the soil in the spring the ground retained its moisture and abundant crops of peaches and apricots were gathered. The climate is too warm for apples.

In regard to insects, the worst we have is the red spider on the almond trees; but by spraying with lime, sulphur, and salt, and a frequent dusting with dry sulphur, it is held in check.

We have very few grapes in this locality. The Tokay is the principal variety, and is a very heavy bearer. Resistant stock is being planted.

Raising almonds in this locality has become an important industry. Land that was, a few years ago, covered with brush, is now covered with almond orchards, and the trees look fine and healthy.

The black scale in this locality does not thrive, as the climate is too warm; but when found, spraying well with kerosene emulsion is sure to kill it.

Respectfully submitted.

J. F. BUSEY,
A. M. GRAVES,
Horticultural Commissioners.

FRESNO COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: The Horticultural Commissioners of the county of Fresno submit herewith their report for the year 1902.

The fruit industry of the county has never before been more flourishing than during the present season. The raisin crop amounted to about 4,800 cars of ten tons each, besides making about 4,500,000 gallons of wine and brandy. We had a large crop of all kinds of dried fruits, with the exception of pears, which were very badly blighted. Our green fruit shipments were light, owing to our small crop of pears, aggregating only about 165 cars.

No subject in fruit culture has attracted so much attention in recent years as the successful production of the California Smyrna fig, called Calimyrna by the originator, George C. Roeding, who has maintained an orchard of sixty acres for fourteen years without deriving any revenue from it. After making many unsuccessful attempts to introduce the wasp, he finally succeeded, with the assistance of the U. S. Department of Agriculture, in establishing, in 1899, this wonderful little insect, the *Blastophaga grossorum*, in his Wild or Capri fig trees. The insect thrived and increased in numbers at a rapid rate, and in 1900 a crop of six tons of California Smyrna figs was harvested, which were pronounced by experts and prominent horticulturists throughout the United States to be of a far superior flavor and sweeter than the imported article. This was the first crop of Smyrna figs ever produced in the United States, and in fact in the world outside of Smyrna, and it demonstrates conclusively that this industry has a great future in this State and in other States with a climate similar to our own, in spite of the many theories which had been advanced that this fig could be grown in Smyrna alone. The crop for the season of 1901 was forty tons, and that of 1902 was fifty tons, and will no doubt be much larger next year, as the little wasp is now thoroughly acclimated and has withstood as low a temperature as 20° F. above zero without injury.

Olive culture is making its way to the front. There are 16,394 bearing trees and 21,060 non-bearing trees in orchards, and a great many more will be put out this season.

The citrus fruits from this section are remarkably early and free from smut, scale, and all insect pests. These fruits are also attracting much attention, especially along the Sierra foothills in this county. In what is known as the thermal belt, there were about 300 acres planted to oranges and lemons during 1902.

There was also a very large acreage put out to wine grapes this season. The planting of deciduous trees is mostly confined to peaches and pears.

The orchards of the county are, generally speaking, well cared for and reasonably free from disease and insect pests, with the exception of pears, which were badly blighted.

The Commissioners look forward to the coming year with confidence and gratification for the stimulus given the industry during the last few years.

The future is bright indeed.

Respectfully submitted.

W. D. WEAVER,
Secretary.

HUMBOLDT COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: Pursuant to requirements, we submit herewith the annual report of the Humboldt County Board of Horticultural Commissioners.

Apples are as yet the only fruit produced in commercial quantities in this county. The general condition of orchards may be termed satisfactory, with continued increase from new-bearing settings. To some extent the neglect, abandonment, and final destruction of old orchards have offset a portion of the natural increase in yield, but with the added care being bestowed and the importance of constant attention, which this Board has impressed upon all orchardists, the prospects for increased yield of first-class quality are very promising.

This section has been fortunate in escaping to a great extent any serious damage from scale of any kind. Along the belt lying in proximity to the coast, the weather conditions are such as to retard any rapid development of San José or any other pernicious scales, and consequently there is, with the exception of oyster scale, hardly any to be found. Fungous growths are more noticeable, and those which affect the fruit itself show their effect in producing scab which attacks certain varieties every season. The beneficial results of proper spraying for this trouble are being recognized, and the Bordeaux mixture has of late been applied with good success.

In the warmer belt removed from the coast, San José scale existed to a limited extent for a number of years, and during the past few seasons developed quite rapidly, threatening several orchards with complete destruction. Owing to limited transportation facilities, most of these orchards have not been sufficiently profitable to encourage the necessary attention required, and this has contributed to the increase of this pest. At the same time, it has demonstrated the absolute necessity of remedial measures to prevent destruction, and these have been applied more thoroughly during the past six months than at any previous time.

Codling-moth is virtually unknown in this county, although it exists in one orchard in the Mattole section to the south, and in Orleans and Trinity to the north—both away from the coast line. Hardly any of the fruit from either of these sections comes to market, and for some time local inspectors have been instructed to prevent its passing beyond a given line.

This freedom from infection of most all kinds probably makes Humboldt apples the cleanest and healthiest that reach the market from any given section in this State, and the preference manifested wherever they have become known promises increased demand.

Owing to the lateness of seasons here, considerable fruit is imported from other sections, including early apples, peaches, plums, etc., until summer is well advanced. All of this has to pass examination by the local inspectors. This season the regulations have been applied more stringently than ever, and much has been condemned which was reported as having passed quarantine at other points. The same rule applies to fruit coming to Eureka from other parts of the county.

Respectfully submitted.

J. E. JANSSEN,
Secretary.

LASSEN COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: The County Board of Horticulture of Lassen County submits the following:

The orchards of this county have yielded a good average crop. Our fruits are limited to the hardy varieties, such as the apple, pear, peach, plum, prune, etc., together with almost all kinds of berries. Our main fruit crop, however, is the apple, to which our climate and soil seem specially adapted, as the quality can not be excelled anywhere. The pest known as the codling-moth has done, and is still doing, this business serious damage. We are hoping and think that the Hazelton moth-trap, or some similar device, will be the means of destroying this pest. Where this trap was used continuously during the season of the moth's active work, the result seemed to merit its recommendation.

Respectfully submitted.

I. N. JONES,
President.

MADERA COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: I beg leave to submit to your honorable body the following report of the fruit interests in our county:

Through the courtesy of Professor Bioletti and his valuable assistance, we made a thorough examination of all the vineyards in this county for phylloxera. After a thorough search, none was found, nor any evidence of its presence in any of our vineyards. I accompanied the professor to Fresno on the same errand. With the assistance of Mr. Scott, the Horticultural Commissioner of Fresno, I was enabled to have a map made of the infested district of that county. I have furnished one of these maps to each of the wineries and requested them to refuse to buy from within certain lines. Mr. Rossi, President of the Italian-Swiss Colony Vineyard, and Mr. Minturn, of Minturn Vineyard, both in this county, assured me that they would gladly accede to my request, thereby obviating the necessity of more stringent measures to prevent the influx of this terrible pest.

The San José scale has secured a strong hold in our county in several places. While we have done much to eradicate it, we find many of the orchardists rebel at being served with notices to spray; but I have yet to find, after understanding the good that will accrue from spraying, one who will object, and in fact, the most stubborn, after they have sprayed once, are our best supporters.

Every package of trees or vines delivered at any station in this county has been examined for insects, and many of them were processed to eradicate the same. We have found carbon bisulphide the most effective in this work.

Under the instructions of Alexander Craw, who has given us many valuable remedies for the several insect pests, we have been able to accomplish much. Being new at the business, we find the advice of such experienced gentlemen very valuable.

We have received reports for publication from the Experiment Station at Berkeley, on specimens sent by us from time to time, which have been very beneficial to horticulturists of this county. These reports have been thorough and to the point. With such assistance one need have no trouble in determining the cause of an orchard being in bad shape.

Our Board of Supervisors has aided in every way possible the work of this Commission, providing us with spray-pumps and processing-closets for disinfecting, and instructing us at all times to do the work in a thorough manner, regardless of cost.

Respectfully submitted.

W. M. HUGHES.

MONTEREY COUNTY.

To the Honorable the State Board of Horticulture:

Gentlemen: In the Pleyto district of this county a thorough inspection of all the orchards has been made, and where the formulas of your Board for the destruction of pests have been thoroughly applied at least ninety-five per cent of the greedy scale, which infests many of the orchards in the vicinity of Metz, have been destroyed.

There is very little San José scale to contend with, and it is well under control, as is also the black scale in the vicinity of San Ardo. About 58,000 trees have been inspected in this district, and with few exceptions they were in good condition and heavily laden with fruit.

In the Pajaro district, in this county, the main fruit crop is apples, although many prunes and apricots are raised successfully. This season's apple crop is medium; apricots and prunes are a full crop of good quality. The general condition of orchards is somewhat better than last year's. We have to contend with the greedy and brown apricot scales, the woolly aphis, and red spider, with very little San José scale. Codling-moth is also bad in sections. The scales have been reduced in number by the use of winter sprays. The codling-moth is a persistent worker, and even where sprayed two or three times with Paris green it has done considerable damage. The red lady-bug is doing good work among the woolly aphis. In this district we have 366,874 trees of all kinds, distributed as follows:

	Bearing.	Non-Bearing.	Total.
Apples—			
Newtown Pippin	35,025	110,420	145,445
Bellefleur	32,995	69,665	102,660
Ben Davis	1,050	------	1,050
Missouri Pippin	2,665	600	3,265
Red Pearmain	11,465	200	11,665
Mixed	17,545	5,100	22,645
Baldwin	950	------	950
White Winter Pearmain	1,500	4,205	5,705
Black Twig	450	100	550
Langford Seedling	470	------	470
Winter Pearmain	500	------	500
Total apples	104,615	190,290	294,905
Apricots	22,345	204	22,549
Pears	3,485	------	3,485
Peaches	1,955	------	1,955
Prunes	41,365	------	41,365
Cherries	1,415	------	1,415
Walnuts	------	200	200
Almonds	1,000	------	1,000
Total of all fruits	176,180	190,694	366,874

Respectfully submitted.

D. W. ROHRBACK,
Secretary.

ORANGE COUNTY.

To the Honorable the State Board of Horticulture:

Gentlemen: I beg to submit the following:

Generally I think Orange County may be considered prosperous, although the demoralization of the lemon market and the exceptionally low prices for dried fruits have had a depressing effect on those industries for the present season. With oranges and walnuts it has been quite to the contrary, however.

The practice of fighting insect pests by fumigation of the orchards once each year has reduced the red scale to a minimum; and a minute yellow fly, which is present this season in great numbers, in many instances has proved as destructive to the red scale as fumigation. We therefore believe that the treatment of orchards for red scale will soon become unnecessary.

But while the above treatment has been so satisfactory as against the red scale, the same can not be said of the warfare against the black scale, which, owing to its different life history and the fact that fumigation does not devitalize the egg, has been gradually increasing for four or five years, until now the presence of this insect presents quite a serious aspect, as the cost of fumigation twice each year is almost prohibitive.

The purple scale has been found in three or four very limited areas, but energetic measures have been adopted, with the hope of exterminating it.

Beneficial insects, while not numerous, are much more so than in the past.

Foot rot and scaly bark, gum disease of the orange and gum disease of the lemon are all sufficiently prevalent to attract attention.

While the Anaheim vine disease is showing a very marked effect on the older of the replanted vineyards, it would seem that the season of usefulness of some was at an end.

The disease of the walnut has generally been less destructive this year than last, and has attracted very little attention.

Respectfully submitted.

A. D. BISHOP,
Secretary.

PLACER COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: In compliance with section four of the law relating to Boards of Horticulture, I submit the following:

Placer County has been unfortunate during the past year in the loss, by death, of our esteemed Secretary, George W. Applegate. Mr. Applegate was one of the pioneer horticulturists of our county, and in his death the county has lost one of her most progressive horticulturists and one of her most upright and honored citizens.

From January to July of the present year, we have had with us Professor Warren T. Clarke, of the Horticultural Department of the State University, who was sent to our county to make a study of fruit insect pests, and particularly of the peach-moth. The Supervisors of our county made liberal appropriations from time to time to defray his expenses and to compensate him for his services while in the discharge of his duties in our county. Professor Clarke visited all the principal fruit-growing sections of our county, and as far as it was possible for them to do so, some members of our Horticultural Board accompanied him; and we feel that his presence has been of great benefit to us and to our county. He demonstrated the fact that the peach-moth lives in the form of a worm through the winter by boring a hole under the bark of the peach trees, generally in forks of the smaller branches. There was scarcely an orchard he visited but what the live worms were found in large numbers. In some cases the worms were so small, particularly early in the winter, that they were scarcely visible without the aid of a glass. In other cases, they were nearly full grown; and as the season advanced, we found that they were larger and more lively. As the weather became warmer toward spring, in many cases we found the worms nearly full grown, and in some cases they had left their hiding places and were crawling around on the outside of the branches of the trees. This demonstrates the fact that late spraying is the only effective way of eradicating the pest, and we therefore recommend the spraying of the trees as late as it can be done without injury to the fruit.

We found by actual experiment that peach trees when in full bloom can be sprayed with the lime, sulphur, and salt solution without appreciable injury, by putting in a little less quantity of lime than the regular formula, say twenty to twenty-five pounds of lime, fifteen pounds of sulphur, and eight or ten pounds of salt to forty gallons of water; the mixture to be thoroughly boiled before using. No matter how strong the solution, it can do but little good to put it on in the winter when the worm is covered by the bark of the tree. In a few cases other kinds of sprays were used, and in all such cases the fruit was very wormy, and no appreciable results were obtained from the spraying; but when the spraying with the lime, sulphur, and salt was properly done, the fruit was comparatively free from worms; thus proving beyond all question that the only effective spray for peach trees, thus far discovered, is the lime, sulphur, and salt mixture.

In regard to pears and apples, spraying with Paris green or a preparation of arsenic has been followed, with generally satisfactory results; but the crops of all deciduous fruits have been so large that more than usual has been lost through the ravages of insect pests.

In all fruit-growing sections of the State, the crops have been unusually heavy, labor scarce, and wages high, in consequence of which large quantities of all kinds of fruit have been permitted to go to waste. As far as my observations have gone, the ground in all bearing orchards was covered with decaying fruit because of insufficient help to gather it, and also owing to the low prices received for that which had been gathered. I speak of this here to emphasize the necessity of thorough spraying next season, for the large amount of fruit rotting in the orchards everywhere will certainly be the means of producing an unusual amount of insect pests next season.

Pear-blight has thus far made but little headway in Placer County. It has been treated with the Bordeaux mixture and other recommended remedies, but with what result I am at this time unable to state.

In concluding, permit me to say that in my opinion, if the boards of trade, chambers of commerce, immigration societies, improvement associations, and the thousand and one organizations in this State trying to induce others to come here and engage in horticultural pursuits, would devote their energies to securing *quicker* and *cheaper* transportation to the Eastern markets for the products of those already engaged in the business, it would be of more benefit to the people and to the State.

Respectfully submitted.

JOHN ADAMS,
Chairman and Acting Secretary.

RIVERSIDE COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: The Horticultural Commission of the County of Riverside has the honor to submit herewith its report for the year 1902, as provided by law.

The horticultural industry of Riverside County, despite the drought and other adverse conditions, has steadily grown in the past year. The gradual decrease of the water-supply of the past has stimulated the development of water from new sources to the extent that in two years over ten thousand inches of water have been added to the irrigation ditches of the county. With the continued persistent operations of the developers of water, this county is assured of a permanent and bountiful supply, and the consequent success of its orchardists.

The increasing ratio of the importance of the industry is best shown by an examination and comparison of the valuations of the properties of the county. The total assessed valuation of all properties is $13,498,384; of acreage property, $5,173,107; of the improvements thereon, $2,016,955, of which $912,395, or nearly one half, is in the valuation of trees. The valuation of the trees is nearly equal to the value of city and town lots ($1,106,719), or of the buildings and improvements on same ($1,418,420), and is fifty per cent greater than the value of all personal property ($648,540).

The crop of the past year, in points of quantity or of quality, was not up to the splendid standard of most favorable years, but was handled most scientifically in packing and marketing. The progressive spirit of our fruit men, together with their extended experience, has resulted in one of the best cured and best packed crops that has ever been harvested in the county. The citrus crop amounted to 4,439 carloads, of which 3,948 were oranges and 491 were lemons.

The harvesting and curing of the deciduous crop have not been completed, but enough has been cured and packed to permit a very close estimate being given. After careful and extended inquiry we estimate cured fruits as follow: Of almonds, 45 tons; apricots, 590 tons; olives, 20 tons; prunes, 429 tons; peaches, 227 tons; plums, 35 tons; pears, 60 tons; raisins, 132 tons; or a total of 1,538 tons. The product in green fruits shipped will approximate an equal number of tons, including 12 tons of cherries.

The prospect for the coming year's crop of citrus fruit is for a larger yield and of better quality. About 900 acres have been planted to citrus fruits in the past year, and about 250 acres to deciduous fruits.

The county has 1,458,263 fruit trees in bearing and 365,219 non-bearing, or a total of 1,823,482, of which 1,570,959 are citrus trees.

The Horticultural Commission of Riverside County, in the inspection of orchards and in the quarantine work of the year, have employed an average of 12 inspectors for a total of 2,742 days. The three Commissioners have been employed a total of 636 days, and have accomplished the thorough inspection of 17,773 acres of orchards; they have found a very satisfactory condition regarding insect infestation, and an increasing interest among the orchardists in the eradication of the pests.

The work of eradication of insect pests, embracing the methods of fumigation, spraying, and the colonization of parasitic insects, comprised the treatment of 27,718 trees. Nearly all such work has been done under the supervision of the Commission. Fumigation was employed upon 12,659 infested trees, and 15,000 trees were sprayed with the several insecticides, principally distillate, which has finally and thoroughly demonstrated its efficacy. The parasitic insects employed include *Vedalia cardinalis*, *Rhizobius ventralis* and *toowombæ*, *Scutellista cyanea*, and a new *Proctotrupidæ*, parasitic of the San José scale, a report on which will be given later.

The utmost vigilance has prevailed in the county to prevent the introduction of injurious insects and diseased trees, plants, etc., and we have, under the quarantine laws, prevented such incursions by promptly returning consignments of stock or fruit or immediately destroying the same.

Respectfully submitted.

W. F. BUDLONG,
Secretary.

SACRAMENTO COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: We herewith submit our annual report of the fruit interests of Sacramento County for the season of 1902.

Regarding insect pests in the orchards, the brown apricot scale, which was rapidly increasing, is more quickly disappearing, since the parasite

(*Comys fusca*) has become well established. Orchards that were badly infested with scale, and tested ten per cent parasitized scale last season, are this season practically clean. We find the parasite well distributed throughout the county.

The codling and peach moths can be found where spraying has been neglected. The codling-moth was bad also in cases where the trees had been well sprayed several times. We attribute this to the spray being washed off by heavy rains.

It has been an established fact with this Board that the lime, sulphur, and salt wash would eradicate the peach-moth. In our report to the County Supervisors of February 9, 1901, we so stated.

The bean-weevil has made its appearance, the crops in some localities being quite badly affected.

Reports of trees dying after the fruit has been well set are quite numerous. In some instances four or five trees in a block will die. We have submitted samples of the roots, wood, and soil to Alexander Craw and to the State University.

The hot, dry north wind in July did extreme damage to the grape crop in some localities. In some cases the Tokay crop was from one half to a complete failure, otherwise California would have harvested her largest crop in grapes. As it was, it was an average crop.

The fruit crop has been a most abundant one with all varieties, large quantities going to waste because of poor prices and lack of help.

On all sides are heard complaints against the railroad companies on account of slow transportation and poor refrigerator service.

The growers feel that they have been unjustly treated by the canneries, which took but a limited quantity, and that of the very best grade. The growers suffered all the losses, as the canneries canned only that amount which they felt sure of marketing.

A large acreage of cling peaches was planted last spring, principally the Levi.

Respectfully submitted.

WILLIAM JOHNSTON,
GEORGE H. CUTTER,
F. M. GRIMSHAW,
Commissioners.

SAN BERNARDINO COUNTY.

To the Honorable the State Board of Horticulture:

Gentlemen: In making our report to your honorable Board we have to say that we are now hard at work with our fumigating outfit, four crews being constantly employed in eradicating the black scale; but notwithstanding the amount of work to do, we are encouraged by the fact that on account of the thorough work done last year we have only about one half the pest to contend with this year that we had at that time. Other pests in this county are kept well under control. The cottony-cushion scale, although found scattered in individual cases in many of the orchards, is now so well kept under by the *Vedalia cardinalis* as to give little cause for anxiety. All necessary care is also taken against the importation of plants and nursery stock of all kinds from infested regions. And if the parasite, *Scutellista cyanea*, that has recently been imported from South Africa and is now being bred by that invaluable officer, Alexander Craw of San Francisco, for the destruction of the black scale, proves a success, the county will soon be freed of that pest also, which confines itself to the western portion.

It is generally estimated that oranges this year will not amount to more than one half to two thirds of a crop; lemons about the same. The cause of this is the dry seasons which we have had for the past five years, compelling growers to sink wells for a supply of water, without which we would have suffered much more.

The deciduous fruit industry in this county in the last three years has fallen off at least sixty per cent of what it formerly was. This is attributed mainly to the same cause.

The wine grape is produced quite extensively on hundreds of acres, with very little of the vine disease.

Conditions in the county as a whole, with the exceptions named, are satisfactory, and with a good rainfall in the coming season to increase the water supply we can look forward with confidence to good crops and a healthy state of things in all of our productions.

Respectfully submitted.

ROBERT BOSWORTH,
Chairman.

SAN DIEGO COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: In compliance with the law governing County Boards of Horticultural Commissioners, I herewith submit our annual report for San Diego County.

Tree-planting during the past season was confined mostly to small family orchards of mixed varieties. Quite extensive preparations were made during the winter for grapevine planting, but the months of March and April were so disastrously dry that most people lost their courage, and the planting was therefore comparatively small.

Our citrus orchards as a whole are in very good condition and quite productive, although some few orchards are neglected, owing to lack of water.

The orchard pests are controlled by beneficial insects, fumigation with hydrocyanic acid gas, and in some instances on small trees by the use of sprays. Many of the worst pests are now fully controlled by beneficial insects. Such species as the *Lecanium hesperidum*, *Aspidiotus perniciosus*, and all of the species of aphids that we have here are pests of the past; as is also the *Icerya purchasi*. There are instances where the black scale (*L. oleæ*) is fully controlled by beneficial insects; several species of lady-birds feed on it. *Rhizobius ventralis* are sure to be found on trees infested with this species of scale. The little native internal parasite is found in most of our infested orchards and is often very numerous. Its work does not appear to be complete, as only a small amount of the eggs produced by the black scale is required for its subsistence.

And here I wish to speak of the new African fly, *Scutellista cyanea*. Our much esteemed State Horticultural Quarantine Officer, Alexander Craw, has provided me with colonies of this little friend, and I am very much interested in its progress and its methods of destroying the enemy. It is a much larger insect than the native internal parasite, *Tomocera californica*, and, as far as I have been able to ascertain, its work is complete. The larva requires, for its development, all of the eggs that the scale produces, and disposes of all under the scale. When pupating there remains no trace of egg shells or body of the mother scale under which they are housed. The shell is a perfectly clean apartment. I have great hopes from this little fly, and believe it to be the true internal parasite of the black scale.

On June 23d I received from Mr. Craw three colonies of *Comys fusca*, to be liberated on a tree infested with brown apricot scale. Two colonies were so liberated, the third one being placed on an orange tree infested with *L. oleæ*. On the orange tree the *Comys* have increased to great numbers. Their work, however, appears similar to that of the *Tomocera californica*. I am quite certain that the use of beneficial insects is the right way to control orchard pests.

Mites are controlled by the use of dry sulphur, applied when the plant is damp. Plants that have been infested with silver mites (*Phytoptus oleivorus*) should be treated with sulphur from year to year or until such time as you are satisfied of their absence from the orchard. The closest observer rarely ever discovers this insect until after it has accomplished its work.

Our lemon crop during the past season did not quite come up to that of 1901 in quantity, but prices ruled much higher, and the year has been a prosperous one to the producer.

The orange crop is looking well. During the early summer months we thought the dropping of oranges was so heavy that the crop would be short.

Apricots, peaches, plums, and prunes have each produced good crops, and the quality was excellent. Much of the fruit went to waste, owing to lack of labor and facilities for handling.

The Smith Mountain apple district has a large apple crop, and the fruit in quality is second to none. This locality as yet is free from orchard pests, except the red spider and a small beetle that bores in the apple, although not to exceed one per cent of the crop was infested. The red spider is generally well controlled by late spring rains.

The Julian apple crop is somewhat light, owing to damp weather during the blooming season.

The greatest increase, however, is in the grape crop. It will probably be larger this year than ever before, according to the present indications. The industry is in the best of shape.

Respectfully submitted.

F. AUSTIN,
Secretary.

SANTA BARBARA COUNTY.

To the Honorable the State Board of Horticulture:

Gentlemen: We, the members of the Santa Barbara County Board of Horticultural Commissioners, beg leave to submit our report for the year ending September 30, 1902.

The condition of the fruit industry in Santa Barbara County is very much the same as when we reported one year ago. The light rainfall last winter was not equal to the requirements of the various crops, and consequently the harvest is somewhat under the average.

The citrus orchards have done fairly well; the fumigation and spraying of last year reduced the amount of scale to a very great extent, and the trees have made a good growth, but the fruit has been less in quantity than last year.

Although fumigation seemed to be effectual at the time, we find that the Florida purple scale has reappeared this season in the trees operated upon twice last year, and has spread somewhat. The Rhizobiids, the Orci, and other beneficial insects have done much in some localities to keep the various scales in check. There will be very little fumigation in this county the present season; most of the growers relying on spraying, and the various lady-birds and flies, as the matter of expense must be considered when the price of fruit is low. Our citrus-growers are alive to the fact that their orchards must be kept in a comparatively clean condition, complete extermination of insect pests being impossible. Distillate emulsion, according to the formula of Mr. Frank Kahles, manager of the Crocker-Sperry ranch, Santa Barbara, Cal., is the spray used in this county, and when properly applied gives good results.

The walnut crop promises to be about the same as last year. The nuts are of good size, and are now ready to be harvested. A few orchards showed a slight blight, causing the nuts to wither and drop before they were ripe; but this was not extensive, and the general appearance of walnut orchards is healthy.

Deciduous fruits, of early varieties, suffered from late frosts and lack of moisture to some extent, and the quantity of late fruits will be less than in former years, although the quality will be fair.

The olive crop this year has been very heavy, and the oil produced has been abundant and of excellent quality. The trees have been well supplied with Rhizobiids (*ventralis*), and generally have been in a healthy and clean condition.

The grape crop has been fair, both in quantity and quality, with a few exceptions, where the vines show lack of vigor, and a tendency to die back, similar to the Anaheim disease.

Orchards, fruits, and nursery stocks have been carefully inspected as occasion demanded, and the State and county laws have been enforced. The fruit-growers of this county have shown a commendable disposition to coöperate with the members of the County Horticultural Board, only a few being inclined to evade the requirements for cleaning up; and no one has suggested any change to be made in the State laws.

Respectfully submitted.

C. J. RUSSELL,
JOSEPH DIMMICK,
T. N. SNOW,
Commissioners.

SANTA CLARA COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: I have the honor to submit for your kind consideration my annual report as Entomologist of Santa Clara County.

Although my office does not really fall within the jurisdiction of your Honorable Board, it being under the County Government Act, I have adopted the same rules and regulations as are used by the regular Horticultural Commissioners.

Santa Clara County has added largely to its acreage of orchards, but on the other hand, the vineyard acreage has decreased very materially within the last two years, owing to phylloxera, drought, and other causes.

In the following table you will find a rough estimate of the acreage of horticultural products:

	Bearing.	Non-bearing.
Apples	200	50
Apricots	5,320	115
Cherries	1,290	230
Prunes	35,672	3,670
Plums	480	378
Nectarines	8	2
Peaches	4,980	3,780
Pears	1,210	180
Quinces	12	2
Olives	330	220
Citrus trees	15	12
Figs	16	5
Almonds	150	50
Walnuts	90	20
Table grapes	380	235
Wine grapes	4,500	2,000
Blackberries	242	
Raspberries	155	
Strawberries	237	

In addition to the fruit industry, this county has about 3,000 acres of seed farms, consisting mostly of onion, lettuce, and carrot seeds, with a limited quantity of flower and other seeds. Very large crops of seeds have been harvested, and there is a prospect of adding a large acreage the coming season.

During the last planting season the following trees and plants were sent into the county: Deciduous trees, 143,290; citrus trees, 205; rooted grapevines, 6,057; grape cuttings, 70,000; ornamentals, 12,687; seedlings, 82,500. Of these, 6,126 deciduous trees arrived from Salem, Or., 1,750 trees from Missouri, and 70,000 grape cuttings and 82,500 seedlings from France. All of these shipments were thoroughly inspected, and whenever necessary fumigated or entirely destroyed.

There are several insect pests troubling our orchards, and the worst of all is the peachroot-borer (*Sanninoidea opalescens*). Notwithstanding the fact that the pest is vigorously fought every season, yet it is very hard to exterminate. The best remedy used, so far, is carbon bisulphide, applied in winter when the trees are dormant and when there is no danger of rain following the application. A few years ago, through careless manipulation of this remedy, a large number of trees were killed. This has caused some growers to avoid using the carbon bisulphide, but thorough investigation has shown that damage is not necessary when the material is applied correctly. Digging out the borers by hand is largely practiced by the growers, but very often great damage is done to the tree by cutting away too much bark. As a preventive or barrier against the small, newly hatched borers, several materials have been used, especially a mixture of 50 pounds of lime, 12 pounds of whale-oil soap, and 1½ gallons of coal tar, diluted with enough water to make a thick paste, which has given very good results.

Our fruit trees are infested with several scale insects; the pear diaspis (*Diaspis pyricola*) is the most abundant at present. The olive scale (*Lecanium oleæ*) and the brown apricot scale (*Lecanium armeniacum*) are nearly subdued by their enemies, *Rhizobius ventralis* and *Comys fusca*. The use of beneficial insects as far as practicable has been my policy, and some very good and encouraging results have been obtained. During the summer Mr. Alexander Craw kindly sent me several colonies of predaceous insects, as well as several colonies of true parasites, which I hope will show some beneficial results next year.

The greatest damage which this county has sustained during the last three years is the loss of her large vineyards. The phylloxera is present in nearly every district, but this is not the cause of the great loss. Some vineyards without a trace of phylloxera have died, and again in the same vineyard only certain varieties have succumbed, while other varieties, generally shy bearers, are still vigorous, the heavy bearers generally being dead or nearly so. Scientists differ in regard to the cause of the dead vines, some claiming it to be the Anaheim disease, while others attribute it to several causes, such as heavy cropping, drought, heavy pruning, frost, etc.; but it yet remains a mystery. Many new vineyards on resistant root have been planted, preference being given to the Rupestris St. George.

Respectfully submitted.

EDW. M. EHRHORN,
Entomologist of Santa Clara County.

SANTA CRUZ COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: The Board of Horticultural Commissioners of Santa Cruz County herewith submits its report of the work done during the past year, and showing the condition of the horticultural interests of this county at the present time.

Most of the orchards and vineyards in the principal fruit sections of the county have been inspected by the Commissioners or the local inspectors.

In some parts of the central and northern portions of the county the pernicious scale still exists in large numbers, owing to the fact that no vigorous or systematic war has been waged against it. The Commissioners have as yet been unable to cover all that territory thoroughly and to enforce the law in that regard, but expect to do so this coming winter. In the southern end of the county, where most of the large apple orchards are, this pest has, by spraying, been so reduced in numbers as to be considered practically extinct and no longer a menace to the horticultural interests there. The spray mostly used here for the eradication of the pernicious scale is the lime, sulphur, and salt wash; but owing to the large amount of work in the mixing, and some disagreeable features of its application, we find some opposition to its use, especially among small growers. Some growers have used the crude-oil spray against this pest, with good results.

The codling-moth is a very serious pest in the apple orchards, especially in the foothills, and the owners are fighting it with every known remedy, but without very gratifying success. So serious has this pest become that the general feeling among the apple-growers is that the State Board of Horticulture should aid them by securing some insect enemy of the codling-moth.

The woolly aphis has become quite serious in the valley districts, and through the efforts of Commissioner C. H. Rodgers large quantities (over 1,500,000) of lady-birds (*convergens*) have been imported for its extinction. The success of the experiment is quite encouraging.

Through the courtesy of Mr. Alexander Craw, Commissioner J. H. B. Pilkington has received several colonies of beneficial insects, including *Comys fusca*, *Rhizobius ventralis*, and *Scutellista cyanea*, and distributed them in various orchards in the vicinity of Santa Cruz.

In a very small section of Pajaro Valley considerable damage has been done to the apples by the diabrotica.

On August 20th the Board met Mr. Alexander Craw, State Entomologist, at Watsonville, and a very pleasant and profitable day was spent inspecting the various orchards and berry and onion patches in that vicinity.

The cherry crop was fair, although light in some sections; apricots full crop; prunes heavy crop; apples fair crop; grapes good crop.

Respectfully submitted.

F. W. HITCHINGS,
Secretary.

STANISLAUS COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: We, the County Horticultural Commissioners of Stanislaus County, beg to submit the following report:

We have examined every shipment of trees and vines that has come into our county, and found them to be in excellent condition, excepting a few elms, which were afflicted with leaf aphis and galls, and the trees were immediately destroyed. The varieties and number of trees were 5,000 peach, 1,000 pear, 200 apricot, 200 apple, 10,000 grapevines and cuttings, 1,000 citrus trees, 200 olive, and about 500 of other varieties.

We have succeeded in getting more orchardists to spray each year, and the people are beginning to realize and appreciate the benefits arising from the work of the County Board of Horticultural Commissioners.

Early apples and pears were completely free from the codling-moth, due to spraying in early spring; but the late fruit was almost worthless, as the spraying was not kept up late enough to kill the second brood of moth.

We find the woolly aphis is doing great damage to the roots of the apple trees, and have experimented considerably in endeavors to eradicate it, but the results have not been satisfactory enough to make public.

The San José scale seems to be decreasing very rapidly. The cottony-cushion scale is kept in subjection by the *Vedalia cardinalis.* The brown apricot scale is increasing in some localities.

There is no disease among our grapevines that we can discover, although we have given all our vineyards a thorough examination, and all indications of disease have been thoroughly investigated. We have decided to admit no vines into our county without being thoroughly gased.

W. F. WHEELER,
J. N. STUHR,
A. L. RUTHERFORD,
Commissioners.

SHASTA COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: The appointment of this Board was made so late in the season that there has been practically nothing done, but we hope to do some good work this winter.

I have seen considerable of the fruit and orchards in my own district, having handled considerable fruit. I find the codling-moth very bad in apples; to a less degree in pears. The peach-moth is also very bad. This being rather a new fruit district, it has been free from pests until the past few years; but with the importation of nursery stock and the non-use of sprays, they have had free course. Some growers have begun to fight the pests, and say that they will continue spraying; others think it does not pay, and are indifferent.

A considerable amount of nursery stock was imported into this district from Maryland before there was any Board of Horticulture in the county. These trees must be watched. There is some planting of trees each season, but nothing extensive.

The peach is the principal fruit grown, and closely following are pear, prune, apple, grape, etc. Some semi-tropical fruits are grown as an experiment. There is quite a number of orange and lemon trees in this district, which bear every year a fair crop.

The Board proposes making a thorough investigation over the county. As there is much to be done and the fruit districts are quite scattered, and as the county never before had a Board of Horticultural Commissioners, it makes the task quite a hard one.

Respectfully submitted.

GEORGE A. LAMIMAN,
Secretary.

TEHAMA COUNTY.

To the Honorable the State Board of Horticulture:

GENTLEMEN: The Board of Horticultural Commissioners of Tehama County begs leave to submit its annual report for the year 1902.

Tehama County is just finishing up harvesting the largest and best fruit crop it has ever known. Peaches, apricots, nectarines, and plums come in comparatively free from that detestable pest, the peach-moth, and the nice fruit going into our canneries and drying-sheds serves as an object lesson to those who thought spraying was useless.

Pears and apples from the valley districts are free from the codling-moth, but we find it to be on the increase in the mountain districts. This condition is easily accounted for, as the packing-houses in the mountains are too open to fumigate successfully. We are pleased to note the fact that quite a number of orchardists have awakened to the necessity of having a tight packing-house; then we can reasonably hope to have nice fruit, as every moth may be killed by fumigation if the house is tight.

We are not troubled to any great extent with scale insects; however, the soft brown scale is here on some of our orange trees, but it is easily kept in check.

The European olive-knot that threatened to destroy the olive industry of the entire county last summer is, we believe, entirely eradicated. As there has been so much said about the impossibility of its eradication after it is once in the ground, it perhaps will not be out of place to here state the manner in which we did the work. We prepared a wagon with a large canvas spread in the bottom, on which every tree was placed as soon as it was dug up. We had a bucket near at hand, in which every little fiber root was placed; then the tree and all roots were burned. The dirt taken from the hole was spread out over the ground, so that it would be sure to dry out. So far we have seen no trace of it this year, and we believe the thorough drying is sufficient to destroy all bacterial germs.

There has been a great deal of fruit imported from Oregon, some of which was infected with moths; this was carefully watched and the infected fruit destroyed.

Fruit trees from out of the State have been carefully inspected; those which were infested with any insect or disease were condemned and disinfected or returned to the place from which they came or destroyed here.

Trees throughout the county have made a fine growth this year, which is accounted for from the fact that the fruit-grower has begun to realize that he must not expect a crop unless he gives his trees proper care and cultivation.

Respectfully submitted.

A. W. SAMSON.

TULARE COUNTY.

To the Honorable the State Board of Horticulture:

Gentlemen: The general condition of the county is very satisfactory as far as the work of the Horticultural Commission of this county is concerned.

Nearly all of the growers of both citrus and deciduous fruits are giving much more attention to their trees and are trying to keep them clean.

The brown apricot scale is nearly if not quite gone—cleaned out by the lime, salt, and sulphur wash and by the *Comys fusca*, introduced in this county four years ago.

The lady-bird (*Vedalia cardinalis*) is cleaning out the cottony-cushion scale. In fact, very little scale can be found in the large citrus orchards. Wherever any are found this Commission has placed a colony of this beneficial insect.

The peach and prune crops in this section were the largest ever handled.

The pear crop was almost a complete failure, caused by the pear-blight. It is the opinion of this Board that many pear trees affected with the blight will recover. Thousands of pear trees have been cleaned of the blight as fast as it appeared. These, with trees that were heavily pruned, are showing signs of recovery.

The orange and lemon crops promise to be of extra quality, but less in quantity.

The apple crop in the foothills will be fair as to quantity and of extra quality.

The quarantine regulations are carried out as far as possible.

Many large tracts of land will be planted to wine grapes this fall. The crop of wine and table grapes this year was very large and of fine quality.

Respectfully submitted.

PERRY FOWLER,
S. A. BAGGS,
C. S. RILEY,
Commissioners.

VENTURA COUNTY.

To the Honorable the State Board of Horticulture:

Gentlemen: The Ventura County Board of Horticultural Commissioners beg to report as follows:

Since our last report we have caused an inspection to be made of every citrus tree in the county. The reports of the local inspectors show that there is considerable black scale still in the county. *Rhizobius ventralis* is keeping the black and hemispherical scales pretty well cleaned out near the coast, but in some localities farther inland the lace-wing-fly larvæ are so numerous that they keep down the *Rhizobius*. We are very anxious to get the new South African parasite (*Scutellista cyanea*) introduced where the *Rhizobius* fails, in the hope that the two together will clean up the whole county.

A few trees with purple scale were found three years ago in an old seedling orchard containing about three acres. The county purchased a fumigating outfit for large trees, and a good job of fumigating was done on all the infested trees and on all others near them. For some time not a live scale could be found, and we were pleased; but after a time a few scale would be found in many trees through the orchard, so we decided to fall back on our old remedy, and had every tree in the orchard grubbed up and burned. We also found several trees on a town lot infested with red scale; these were also grubbed up and burned, so we can now report that there is no red or purple scale known to exist in Ventura County.

So little San José scale appeared on the deciduous fruits that we did not think it advisable to order a tree-to-tree inspection of these trees. Many of the poorest deciduous orchards near the coast have been grubbed up and the land planted to the more profitable lima bean.

We rely entirely on the *Vedalia cardinalis* to eradicate the cottony-cushion scale, and very few of these scales can be found in the county.

We still keep a local inspector at each shipping point to prevent the introduction of new pests. By keeping out new pests and placing parasites on those that are already established, we hope to reduce the numbers of the black and other scales until they are as little feared as the brown and cottony-cushion scales.

Respectfully submitted.

J. F. McINTYRE,
W. I. RICE,
J. B. ALVORD,
Commissioners.

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THIRTY-THIRD ANNUAL REPORT

OF THE

INSURANCE COMMISSIONER

FOR THE

STATE OF CALIFORNIA.

YEAR ENDING DECEMBER 31, 1900.

SACRAMENTO:
A. J. JOHNSTON, : : : : : SUPERINTENDENT STATE PRINTING.
1901.

THIRTY-THIRD ANNUAL REPORT

OF THE

INSURANCE COMMISSIONER

FOR THE

STATE OF CALIFORNIA.

Insurance Department,
San Francisco, June, 1901.

To the Hon. Henry T. Gage, *Governor of California:*

Sir: I herewith submit the annual report of this department, showing the business transacted in this State by all insurance companies during the year ending December 31, 1900.

During the year 1900 the following-named companies were admitted to transact business in this State:

Netherlands Fire	The Hague
Glens Falls	Glens Falls, N. Y.
American Bonding and Trust	Baltimore
Manhattan Fire	New York
New Hampshire Fire	Manchester
Delaware	Philadelphia
Occidental	Los Angeles
Conservative Life	Los Angeles
North American Accident	Chicago
Germania Fire	New York
Fidelity Fire	Baltimore
German	Freeport, Ill.

And the following-named companies discontinued business in this State:

Merchants	Providence, R. I.
Norwalk Fire	Norwalk, Conn.
Ministerial Life	Los Angeles
Fidelity Fire	Baltimore

The average percentage of losses to premiums on fire risks for 1900 is 41.9.

The average percentage of losses to premiums on marine risks for 1900 is 58.5.

The ratio of losses to premiums on fire risks for the twenty-six years next preceding was:

For the year 1875	28.3	For the year 1888	50.1
For the year 1876	32.2	For the year 1889	41.7
For the year 1877	31.0	For the year 1890	43.7
For the year 1878	26.3	For the year 1891	36.1
For the year 1879	32.5	For the year 1892	38.9
For the year 1880	32.5	For the year 1893	39.4
For the year 1881	33.3	For the year 1894	44.4
For the year 1882	39.9	For the year 1895	60.6
For the year 1883	39.1	For the year 1896	69.3
For the year 1884	28.5	For the year 1897	55.3
For the year 1885	44.8	For the year 1898	53.8
For the year 1886	51.2	For the year 1899	52.0
For the year 1887	37.6	For the year 1900	41.9

FIRE INSURANCE.

Amount written	$389,177,568 00
Premiums on same	5,795,506 75
Losses paid	2,430,242 35
Ratio of losses to premiums	41.9

MARINE INSURANCE.

Amount written	$208,470,180 00
Premiums on same	1,938,123 83
Losses paid	1,134,047 78
Ratio of losses to premiums	58.5

Apportioned as follows:

TO COMPANIES OF THIS STATE—FIRE INSURANCE.

Amount written	$27,013,192 00
Premiums on same	435,024 17
Losses paid	237,019 87
Ratio of losses to premiums	54.5

MARINE INSURANCE.

Amount written	$30,717,684 00
Premiums on same	293,070 36
Losses paid	160,447 10
Ratio of losses to premiums	54.7

TO COMPANIES OF OTHER STATES—FIRE INSURANCE.

Amount written	$155,967,277 00
Premiums on same	2,397,897 20
Losses paid	1,060,379 18
Ratio of losses to premiums	44.2

MARINE INSURANCE.

Amount written	$7,425,785 00
Premiums on same	121,017 63
Losses paid	63,799 20
Ratio of losses to premiums	52.7

TO COMPANIES OF FOREIGN COUNTRIES—FIRE INSURANCE.

Amount written	$206,197,099 00
Premiums on same	2,962,585 38
Losses paid	1,132,843 30
Ratio of losses to premiums	38.2

MARINE INSURANCE.

Amount written	$201,044,395 00
Premiums on same	1,817,106 20
Losses paid	1,070,248 58
Ratio of losses to premiums	58.9

Respectfully submitted.

ANDREW J. CLUNIE,
Insurance Commissioner.

TABLE NO. 1.

Showing Business of California Insurance Companies for the year 1900—California business.

FIRE.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.	Ratio of Losses to Premiums
Fireman's Fund	San Francisco	$18,674,798 00	$300,825 52	$160,543 52	53.4
Home Fire and Marine	San Francisco	8,338,394 00	134,198 65	76,476 35	56.9
Totals		$27,013,192 00	$435,024 17	$237,019 87	54.5

MARINE.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.	Ratio of Losses to Premiums
Fireman's Fund	San Francisco	$19,063,022 00	$204,842 03	$104,643 43	51.1
Home Fire and Marine	San Francisco	11,654,662 00	88,228 33	55,803 67	63.2
Totals		$30,717,684 00	$293,070 36	$160,447 10	54.7

TABLE NO. 2.

Showing the Amount and Description of Risks in Force on December 31, 1900, of California Insurance Companies—California business.

Name.	Location.	Fire.		Marine.	
		Risks.	Premiums.	Risks.	Premiums.
Fireman's Fund	San Francisco	$36,954,536 00	$544,746 90	$2,596,909 00	$122,662 44
Home Fire and Marine	San Francisco	16,579,946 00	249,535 73	1,931,430 00	50,598 94
Totals		$53,534,482 00	$794,282 63	$4,528,339 00	$173,261 38

TABLE No. 3.

Showing the Business of California County Mutual Fire Insurance Companies for the year 1900.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.
Humboldt County Fire	Ferndale	$36,192 00	$195 41	None.
Los Angeles County Mutual Fire	Los Angeles	281,265 00	1,383 31	None.
Mutual Fire	Paso Robles	14,987 00	300 40	$940 00
Orange County Farmers Mutual Fire	Santa Ana	143,047 00	324 30	380 00
San Bernardino County Mutual Fire	Ontario	67,503 00	191 74	5 00
Santa Clara County Fire	San José	53,515 00	119 45	None.
Scandinavian Mutual Protective Fire	Kingsburg	77,568 00	238 05	None.
Sonoma County Farmers Mutual Fire	Santa Rosa	38,411 00	----------	75 00
Ventura County Mutual Fire	San Buenaventura	65,100 00	588 26	None.
Totals		$777,588 00	$3,340 92	$1,400 00

TABLE No. 4.

Showing the Fire Business of Companies of other States, for the year 1900—California business.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.	Ratio of Losses to Premiums.
Ætna	Hartford	$8,401,911 00	$120,524 59	$59,017 39	49.0
Agricultural	Watertown, N. Y.	1,526,008 00	25,389 90	7,717 07	30.4
American	Newark	2,434,230 00	36,779 20	9,875 49	26.8
American	Boston	1,235,327 00	17,010 33	5,845 61	34.4
American Central	St. Louis	1,911,267 00	29,955 36	13,646 37	45.5
American Fire	Philadelphia	3,175,982 00	56,549 26	28,994 75	51.3
American Fire	New York	2,269,331 00	29,167 53	5,891 03	20.2
Assurance Company of America	New York	111,300 00	1,835 61	26 97	1.5
Boston	Boston	149,683 00	3,787 87	5,901 00	155.8
Caledonian-American	New York	426,390 00	5,388 97	617 45	11.4
Commercial Union Fire	New York	193,630 00	3,154 17	3,022 96	95.8
Continental	New York	9,374,177 00	112,504 61	53,765 76	47.8
Delaware	Philadelphia	628,275 00	9,216 43	303 00	3.3
Equitable Fire and Marine	Providence, R. I.	1,132,973 00	20,055 81	16,590 18	75.2
Fidelity Fire	Baltimore	92,373 00	1,302 23	677 45	52.0
Fire Association	Philadelphia	2,037,683 00	47,193 44	23,319 60	49.4
Franklin Fire	Philadelphia	3,780,923 00	57,459 38	19,080 26	33.2

German	Freeport, Ill.	1,079,858 00	14,127 15	2 50	
German Alliance	New York	1,734,295 00	27,927 57	7,720 28	27.6
German-American	New York	8,513,753 00	131,488 86	63,264 14	48.1
Germania Fire	New York	627,834 00	7,026 80	2 50	
Girard Fire and Marine	Philadelphia	765,843 00	11,673 62	7,414 17	63.6
Glens Falls	Glens Falls	2,242,652 00	30,928 95	4,378 30	14.2
Greenwich	New York	636,584 00	11,973 05	11,136 49	93.0
Hanover Fire	New York	3,028,271 00	50,627 29	20,391 84	40.3
Hartford Fire	Hartford	13,412,108 00	189,960 53	80,568 18	42.4
Home	New York	11,864,094 00	205,810 09	114,998 56	55.9
Insurance Company of North America	Philadelphia	6,011,123 00	92,476 62	47,693 83	51.7
Insurance Company of the State of Pennsylvania	Philadelphia	856,248 00	16,803 85	11,616 96	69.1
Kings County Fire	New York	332,764 00	4,092 75	1,042 45	25.5
Magdeburg Fire	New York	449,269 00	5,912 80	965 35	16.3
Manhattan Fire	New York	569,967 00	12,595 27	2,519 17	20.0
Mercantile Fire and Marine	Boston	953,372 00	13,788 41	4,286 82	31.1
Merchants	Newark	3,094,203 00	44,090 57	22,597 55	51.3
Milwaukee Mechanics	Milwaukee	6,201,672 00	80,146 81	32,327 18	40.3
National Fire	Hartford	4,567,193 00	77,772 18	37,942 12	48.9
National Standard	New York	119,925 00	1,760 25	68 62	3.9
New Hampshire Fire	Manchester	1,002,438 00	14,124 05	1,241 06	8.8
Niagara Fire	New York	2,418,279 00	34,967 24	15,153 80	43.4
North German Fire	New York	751,397 00	9,634 60	1,623 85	16.8
Northwestern National	Milwaukee	5,995,470 00	78,351 83	30,065 04	38.4
Orient	Hartford	1,143,865 00	17,914 67	4,285 68	23.9
Pennsylvania Fire	Philadelphia	7,062,018 00	128,999 91	52,060 93	40.3
Pelican	New York	838,069 00	11,891 25	7,110 29	59.8
Phenix	Brooklyn	2,493,002 00	35,779 34	8,723 23	24.4
Phœnix	Hartford	5,404,297 00	89,309 08	53,724 21	60.2
Providence-Washington	Providence	1,703,171 00	26,522 00	15,049 47	56.7
Queen	New York	3,918,509 00	64,018 95	29,081 49	45.4
Springfield Fire and Marine	Springfield, Mass.	3,337,813 00	56,824 48	20,793 45	36.6
St. Paul Fire and Marine	St. Paul	1,664,561 00	25,961 42	8,779 07	33.9
Teutonia	New Orleans	1,242,006 00	21,091 80	6,974 86	33.1
Thuringia-American	New York	1,355,447 00	19,497 36	8,070 73	41.4
Traders	Chicago	1,392,840 00	20,510 05	6,617 85	32.3
United States Fire	New York	1,231,198 00	17,333 21	7,066 26	40.8
Union	Philadelphia	915,616 00	14,762 24	7,921 53	53.7
Victoria Fire	New York	467,704 00	6,072 34	4,219 65	69.5
Westchester Fire	New York	2,593,952 00	47,736 20	20,560 49	43.1
Williamsburg City Fire	Brooklyn	3,093,134 00	48,337 07	26,027 39	53.8
Totals		$155,967,277 00	$2,397,897 20	$1,060,379 18	44.2

TABLE NO. 5.

Showing the Fire Risks in Force in California on December 31, 1900—Companies of other States.

Name.	Location.	Risks.	Premiums.
Ætna	Hartford	$14,665,801 00	$200,734 80
Agricultural	Watertown, N. Y.	1,611,990 00	26,764 16
American	Newark	3,419,032 00	51,176 29
American	Boston	1,733,638 00	22,875 89
American Central	St. Louis	3,043,340 00	38,440 14
American Fire	Philadelphia	4,034,869 00	69,771 96
American Fire	New York	3,025,774 00	38,890 04
Assurance Co. of America	New York	132,800 00	2,033 35
Boston	Boston	----------	----------
Caledonian-American	New York	284,260 00	3,592 65
Commercial Union Fire	New York	257,730 00	3,178 69
Continental	New York	10,763,307 00	157,969 91
Delaware	Philadelphia	584,291 00	8,976 83
Equitable Fire and Marine	Providence	1,812,756 00	32,089 30
Fidelity Fire	Baltimore	88,666 00	1,288 23
Fire Association	Philadelphia	9,431,841 00	75,958 66
Franklin Fire	Philadelphia	4,159,015 00	63,205 31
German	Freeport, Ill.	1,077,358 00	14,117 21
German Alliance	New York	2,792,183 00	41,759 23
German-American	New York	14,409,230 00	206,135 24
Germania Fire	New York	627,834 00	7,026 80
Girard Fire and Marine	Philadelphia	591,466 00	10,443 86
Glens Falls	Glens Falls	2,354,784 00	32,474 39
Greenwich	New York	1,571,128 00	22,528 26
Hanover Fire	New York	5,283,674 00	83,195 15
Hartford Fire	Hartford	23,576,017 00	339,503 46
Home	New York	18,578,849 00	327,650 42
Insurance Co. of North America	Philadelphia	10,715,994 00	156,863 81
Ins. Co. of the State of Penn.	Philadelphia	1,369,996 00	26,886 15
Kings County Fire	New York	370,096 00	3,492 20
Magdeburg Fire	New York	484,778 00	5,771 95
Manhattan Fire	New York	482,323 00	12,082 79
Mercantile Fire and Marine	Boston	1,218,628 00	16,929 19
Merchants	Newark	3,946,087 00	54,067 48
Milwaukee Mechanics	Milwaukee	10,766,509 00	128,606 41
National Fire	Hartford	4,546,816 00	77,382 40
National Standard	New York	131,925 00	1,757 36
New Hampshire Fire	Manchester	935,924 00	13,236 78
Niagara Fire	New York	2,820,465 00	46,520 40
North German Fire	New York	791,647 00	10,135 40
Northwestern National	Milwaukee	16,681,210 00	156,675 79
Orient	Hartford	1,029,478 00	16,123 20
Pennsylvania Fire	Philadelphia	11,503,001 00	202,055 48
Pelican	New York	827,094 00	11,975 15
Phenix	Brooklyn	2,708,191 00	48,833 01
Phœnix	Hartford	8,581,912 00	129,600 83
Providence-Washington	Providence	2,491,986 00	38,104 60
Queen	New York	6,395,494 00	90,772 77
Springfield Fire and Marine	Springfield, Mass.	3,287,866 00	56,116 40
St. Paul Fire and Marine	St. Paul	3,400,744 00	38,805 53
Teutonia	New Orleans	1,639,715 00	23,692 84
Thuringia-American	New York	2,279,613 00	34,200 00
Traders	Chicago	1,503,129 00	22,193 10
United States Fire	New York	1,155,637 00	17,287 66
Union	Philadelphia	1,281,053 00	18,247 74
Victoria Fire	New York	509,443 00	6,566 22
Westchester Fire	New York	2,563,611 00	47,086 20
Williamsburg City Fire	Brooklyn	3,402,447 00	53,170 77
Totals	----------	$239,734,445 00	$3,447,019 84

TABLE No. 6.—*Showing the Fire Business of Companies of Foreign Countries for the year 1900—California business.*

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.	Ratio of Losses to Premiums.
Aachen and Munich Fire	Aix-la-Chapelle	$6,332,191 00	$93,762 56	$32,260 94	34.4
Alliance	London	4,728,148 00	64,475 22	26,247 93	40.7
Atlas	London	5,648,079 00	81,305 46	23,058 59	28.3
Baloise Fire	Basle	1,215,813 00	15,242 76	2,937 51	19.3
British America	Toronto	2,610,804 00	41,651 71	18,132 33	43.5
Caledonian	Edinburgh	4,500,008 00	65,618 65	21,542 05	32.8
Commercial Union	London	7,968,472 00	109,135 19	59,631 07	54.7
Hamburg-Bremen Fire	Hamburg	5,950,984 00	88,182 16	27,494 74	31.2
Helvetia Swiss Fire	St. Gall	2,830,519 00	36,916 34	6,339 83	17.2
Imperial	London	5,570,632 00	84,864 03	36,297 28	42.7
Lancashire	Manchester	5,675,493 00	83,452 53	26,709 69	32.0
Law, Union, and Crown	London	1,754,650 00	23,229 47	11,917 74	51.5
Lion Fire	London	3,098,615 00	48,579 79	22,538 69	46.4
Liverpool and London and Globe	Liverpool	14,267,218 00	191,057 98	76,107 65	39.8
London	London	4,489,060 00	60,304 09	17,928 91	29.7
London and Lancashire Fire	Liverpool	13,727,316 00	183,678 61	60,712 88	33.1
Magdeburg Fire	Magdeburg	3,580,249 00	52,789 05	22,694 75	43.0
Manchester Fire	Manchester	5,437,846 00	78,890 80	31,322 72	39.7
Netherlands Fire	The Hague	3,611,276 00	44,671 79	7,211 41	16.1
New Zealand	Auckland	2,734,565 00	39,014 76	19,214 06	49.2
North British and Mercantile	London	6,602,084 00	99,065 30	29,189 37	29.4
Northern	London	4,489,060 00	60,304 09	17,928 91	29.7
North German Fire	Hamburg	6,365,601 00	89,284 84	30,719 34	34.4
Norwich Union Fire	Norwich	6,078,953 00	93,805 47	33,524 00	35.7
Palatine	Manchester	5,864,706 00	89,129 46	41,249 44	46.3
Phœnix	London	7,628,252 00	109,204 70	61,637 38	56.4
Prussian National	Stettin	2,785,895 00	35,791 65	19,917 53	55.6
Royal	Liverpool	9,703,965 00	145,020 12	63,693 76	43.9
Royal Exchange	London	8,213,134 00	109,024 30	35,955 07	32.9
Scottish Union and National	Edinburgh	4,604,464 00	67,809 32	25,040 61	36.9
State Fire	Liverpool	1,371,749 00	20,061 40	2,820 50	14.1
Sun Fire	London	5,962,182 00	90,711 95	42,022 87	46.3
Svea	Gothenburg	4,892,320 00	96,074 30	43,132 82	44.9
Thuringia	Erfurt	10,910,967 00	153,296 02	48,910 94	31.9
Transatlantic Fire	Hamburg	7,171,349 00	102,554 62	36,546 13	35.6
Union	London	3,649,599 00	49,935 39	27,079 55	54.2
Western	Toronto	4,170,881 00	64,689 50	23,174 31	35.8
Totals		$206,197,099 00	$2,962,585 38	$1,132,843 30	38.2

TABLE No. 7.

Showing Fire Risks in Force on December 31, 1900—Companies of Foreign Countries—California business.

Name.	Location.	Risks.	Premiums.
Aachen and Munich Fire	Aix-la-Chapelle	$9,706,828 00	$130,481 31
Alliance	London	6,597,184 00	89,962 27
Atlas	London	11,010,742 00	143,028 61
Baloise Fire	Basle	1,542,328 00	17,740 96
British America	Toronto	3,484,929 00	55,288 06
Caledonian	Edinburgh	7,943,480 00	106,772 89
Commercial Union	London	11,155,860 00	152,789 26
Hamburg-Bremen Fire	Hamburg	8,734,760 00	135,632 00
Helvetia Swiss Fire	St. Gall	4,335,059 00	51,497 93
Imperial	London	8,300,242 00	113,717 80
Lancashire	Manchester	10,599,680 00	144,873 94
Law, Union, and Crown	London	1,965,208 00	25,565 19
Lion Fire	London	4,616,936 00	65,096 92
Liverpool and London and Globe	Liverpool	21,621,058 00	316,870 05
London	London	7,867,374 00	100,175 48
London and Lancashire Fire	Liverpool	14,902,813 00	199,727 97
Magdeburg Fire	Magdeburg	6,165,180 00	79,915 85
Manchester Fire	Manchester	7,392,423 00	113,927 81
Netherlands Fire	The Hague	3,250,148 00	40,204 61
New Zealand	Auckland	7,074,756 00	89,621 93
North British and Mercantile	London	11,176,943 00	158,397 20
Northern	London	7,867,374 00	100,175 48
North German Fire	Hamburg	10,176,251 00	145,274 88
Norwich Union Fire	Norwich	10,266,859 00	142,640 80
Palatine	Manchester	7,330,882 00	111,412 82
Phœnix	London	11,984,743 00	166,721 51
Prussian National	Stettin	5,298,757 00	64,148 21
Royal	Liverpool	16,453,734 00	230,004 07
Royal Exchange	London	15,423,070 00	202,149 55
Scottish Union and National	Edinburgh	11,879,518 00	157,995 71
State Fire	Liverpool	1,277,963 00	18,498 78
Sun Fire	London	9,112,035 00	123,181 69
Svea	Gothenburg	5,812,011 00	112,087 14
Thuringia	Erfurt	18,364,938 00	257,109 13
Transatlantic Fire	Hamburg	10,303,766 00	136,878 66
Union	London	4,815,297 00	60,191 23
Western	Toronto	6,276,686 00	97,106 50
Totals		$322,087,815 00	$4,456,864 20

TABLE No. 8.

Showing the Business of Marine Insurance Companies, for the year 1900—California business.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.	Ratio of Losses to Premiums.
Alliance	Berlin	$3,759,328 00	$52,762 45	$37,025 15	70.1
Alliance Marine	London	1,940,750 00	20,871 33	6,905 26	33.1
American and Foreign Marine	New York	415,685 00	815 11	2,504 27	307.2
Baloise	Basle	10,168,812 00	98,141 57	54,762 00	55.8
Boston	Boston	645,082 00	15,641 06	867 91	5.5
British and Foreign Marine	Liverpool	19,402,281 00	122,694 87	80,496 41	65.6
Canton	Hong Kong	11,825,621 00	77,797 02	36,724 63	47.2
China Traders	Hong Kong	2,040,037 00	6,591 26	78 10	1.2
Commercial Union	London	7,115,214 00	45,862 20	18,044 38	39.1
Fonciere	Paris	7,218,381 00	68,893 85	58,291 10	84.6
Frankfort Marine	Frankfort, Germany	10,338,289 00	110,823 85	101,479 45	91.6
Helvetia General	St. Gall, Switzerland	10,168,812 00	98,141 58	54,762 00	55.8
Imperial Marine	Tokio	2,798,522 00	27,299 75	17,352 47	63.6
Indemnity Mutual Marine	London	1,362,221 00	20,823 87	12,519 81	60.1
Insurance Company of North America	Philadelphia	3,113,397 00	52,346 00	38,912 83	74.3
London	London	1,754,106 00	17,894 55	8,054 81	45.0
London and Provincial Marine	London	1,890,113 00	28,150 45	27,293 96	96.9
Mannheim	Mannheim	1,267,890 00	2,086 98	454 46	21.8
Man On	Hong Kong	693,630 00	1,924 67		
Marine	London	2,839,215 00	40,875 05	41,697 49	102.0
Maritime	Liverpool	3,586,251 00	54,253 65	32,253 04	59.4
Munich	Munich	3,759,328 00	52,762 45	37,025 15	70.1
New Zealand	Auckland	2,575,000 00	36,108 50	18,071 86	50.0
Nippon Sea and Land	Osaka	2,309,913 00	57,439 91	40,083 50	69.8
North China	Shanghai	10,620,188 00	24,887 25	2,337 99	9.4
Ocean Marine	London	9,692,386 00	23,645 61	7,298 66	30.9
Po On	Hong Kong	273,638 00	717 65		
Providence-Washington	Providence	1,839,049 00	30,661 35	16,674 12	54.4
Prussian National	Stettin	696,771 00	2,921 69	1,221 32	41.8
Reliance Marine	Liverpool	1,104,533 00	15,512 18	6,701 38	43.2
Royal Exchange	London	4,542,005 00	2,665 49		
Sea	Liverpool	1,154,240 00	16,789 94	4,595 00	27.4
Standard Marine	Liverpool	8,128,622 00	64,243 28	33,201 11	50.1
St. Paul Fire and Marine	St. Paul	1,412,572 00	21,554 11	4,840 07	22.5
Switzerland General	Zurich	10,168,812 00	98,141 58	54,762 00	55.8
Thames and Mersey	Liverpool	4,436,853 00	87,193 59	10,308 70	11.8
Union Marine	Liverpool	1,433,775 00	21,038 34	7,959 16	37.8

TABLE No. 8—Continued.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.	Ratio of Losses to Premiums.
Universo Marine	Milan, Italy	$916,439 00	$17,630 25	$11,636 99	66.0
Western	Toronto	1,998,695 00	58,516 14	47,258 41	80.7
Wilhelma	Magdeburg	3,057,539 00	29,008 85	17,144 65	59.1
Yangtse	Shanghai	3,288,501 00	18,924 19	22,001 08	116.3
Totals		$177,752,496 00	$1,645,053 47	$973,600 68	59.2

TABLE NO. 9.

Showing Marine Risks in Force on December 31, 1900—California business.

Name.	Location.	Risks.	Premiums.
Alliance	Berlin	$660,214 00	$17,170 55
Alliance Marine	London	863,542 00	9,747 85
American and Foreign Marine	New York	24,500 00	133 72
Baloise	Basle	1,401,111 00	55,695 27
Boston	Boston	159,220 00	11,313 84
British and Foreign Marine	Liverpool	2,700,257 00	38,655 75
Canton	Hong Kong	742,740 00	31,019 62
China Traders	Hong Kong	192,451 00	479 46
Commercial Union	London	1,076,141 00	14,854 67
Fonciere	Paris	1,316,134 00	40,541 30
Frankfort Marine	Frankfort	971,789 00	52,793 52
Helvetia General	St. Gall	1,401,113 00	55,695 29
Imperial Marine	Tokio	498,022 00	19,583 24
Indemnity Mutual Marine	London	729,979 00	10,777 83
Insurance Company of North America	Philadelphia	743,665 00	32,238 60
London	London	525,220 00	7,280 98
London and Provincial Marine	London	889,363 00	13,693 83
Mannheim	Mannheim	10,179 00	58 95
Man On	Hong Kong	99,360 00	293 26
Marine	London	1,366,055 00	19,953 66
Maritime	Liverpool	1,055,347 00	32,996 11
Munich	Munich	660,214 00	17,170 55
New Zealand	Auckland	711,074 00	23,097 07
Nippon Sea and Land	Osaka	724,343 00	40,504 56
North China	Shanghai	538,884 00	4,001 96
Ocean Marine	London	835,587 00	8,058 83
Po On	Hong Kong	10,023 00	26 65
Providence-Washington	Providence	432,592 00	19,355 73
Prussian National	Stettin	None.	None.
Reliance Marine	Liverpool	593,043 00	8,070 44
Royal Exchange	London	None.	None.
Sea	Liverpool	585,675 00	8,612 32
Standard Marine	Liverpool	689,191 00	10,557 77
St. Paul Fire and Marine	St. Paul	292,155 00	11,828 31
Switzerland General	Zurich	1,401,113 00	55,695 29
Thames and Mersey	Liverpool	1,792,083 00	54,182 48
Union Marine	Liverpool	714,545 00	11,530 87
Universo Marine	Milan	247,758 00	11,329 35
Western	Toronto	722,247 00	36,801 34
Wilhelma	Magdeburg	384,457 00	7,388 30
Yangtse	Shanghai	330,629 00	4,175 58
Totals		$29,092,015 00	$797,364 70

TABLE NO. 10.

Showing New Policies Written during the year, Policies Renewed, and Amount of Policies in Force on December 31, 1900, of Life Insurance Companies doing business in California—California business.

Name.	Location.	New Policies Written.			Policies Renewed.			Policies in Force December 31, 1900.		Losses and Endowments Paid.
		No.	Amount.	Premium.	No.	Amount.	Premium.	No.	Amount.	
Ætna Life	Hartford	214	$551,500 00	$22,747 33	794	$1,879,156 00	$65,726 30	1,202	$2,546,170 00	$36,568 00
Connecticut Mutual Life	Hartford	305	569,500 00	21,375 50	1,652	4,075,329 00	139,632 26	2,368	5,381,967 00	161,241 32
Conservative Life	Los Angeles	1,405	1,792,130 00	43,328 09						4,000 00
Equitable Life	New York	1,292	3,270,950 00	136,682 66	4,947	15,711,969 00	616,967 00	7,216	20,610,316 00	412,725 04
Fidelity Mutual Life	Philadelphia	349	679,900 00	19,542 69	1,309	2,938,084 00	64,442 76	1,658	3,617,984 00	25,397 00
Germania Life	New York	246	451,000 00	17,747 05	986	2,569,500 00	106,511 07	1,285	3,481,499 00	88,307 09
Home Life	New York	224	529,555 00	19,641 32	866	2,029,500 00	79,416 72	1,164	2,576,173 00	8,950 00
Manhattan Life	New York	170	456,500 00	20,132 35	975	3,020,660 00	117,482 99	1,461	3,949,994 00	49,501 00
Massachusetts Mutual Life	Springfield	113	186,500 00	5,860 36	461	884,321 00	41,123 32	574	1,070,821 00	17,000 00
Mutual Life	New York	1,935	4,822,689 00	245,963 30	7,397	22,595,600 00	944,805 67	10,880	30,483,620 00	594,966 22
Mutual Benefit Life	Newark	315	771,350 00	35,740 03	1,341	4,447,226 00	174,746 12	1,788	5,567,017 00	96,199 33
National Life	Montpelier, Vt.	246	602,500 00	21,129 38	1,037	2,250,964 00	80,307 42	1,283	2,853,464 00	10,300 00
New England Mutual Life	Boston	552	918,000 00	36,477 93	2,511	5,926,000 00	233,575 77	3,585	7,485,673 00	79,210 00
New York Life	New York	2,355	5,315,350 00	245,769 66	5,974	19,255,318 00	723,413 13	9,277	26,274,890 00	360,568 02
Northwestern Mutual Life	Milwaukee	628	1,400,630 00	64,258 68	3,844	9,848,831 00	290,621 48	4,623	11,580,092 00	109,518 12
Pacific Mutual Life	San Francisco	1,380	2,198,500 00	88,453 67	3,217	7,318,500 00	284,645 55	4,646	9,819,896 00	177,361 00
Penn Mutual Life	Philadelphia	890	2,311,250 00	86,991 17	2,067	5,719,050 00	194,560 13	2,957	8,030,300 00	43,198 85
Phœnix Mutual Life	Hartford	194	391,000 00	16,738 67	263	518,230 00	20,355 16	457	909,230 00	16,891 71
Provident Savings Life	New York	216	687,000 00	21,216 86	585	1,585,500 00	41,730 71	800	2,269,767 00	38,269 83
Travelers	Hartford	138	283,000 00	11,054 19	667	1,665,217 00	55,377 61	812	1,948,217 00	27,200 00
Union Central Life	Cincinnati	110	302,644 00	16,398 74	575	1,414,031 00	49,979 96	685	1,716,675 00	18,559 00
Union Mutual Life	Portland, Me.	638	869,438 00	30,440 51	1,460	2,453,497 00	85,711 52	2,384	3,776,646 00	33,894 40
Washington Life	New York	152	409,500 00	22,928 15	275	651,724 00	21,661 12	495	1,084,746 00	20,824 40
Totals		14,067	$29,770,386 00	$1,250,618 29	43,202	$118,758,207 00	$4,432,793 77	61,600	$157,035,157 00	$2,430,650 33

TABLE No. 11.

Showing the Business of Accident Insurance Companies for the yea1 1900—California business.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.
Ætna Indemnity	Hartford	Did no business.		
Ætna Life	Hartford	$7,546,300 00	$21,258 54	$9,421 84
Employers Liability	London			
Fidelity and Casualty	New York	13,964,650 00	41,799 40	16,423 76
Frankfort-American	New York	85,000 00	295 00	None.
Frankfort Marine Accident and Plate Glass	Frankfort, Ger.	2,052,000 00	15,208 74	12,908 81
London Guarantee and Accident	London	1,125,500 00	4,390 00	2,225 11
Maryland Casualty	Baltimore	1,966,750 00	1,994 44	276 24
North American Accident	Chicago	322,000 00	1,522 15	35 70
Pacific Mutual Life	San Francisco	16,455,550 00	114,560 52	35,036 83
Preferred Accident	New York	15,946,300 00	35,288 25	12,708 36
Standard Life and Accident	Detroit	4,602,500 00	22,287 00	3,263 20
Travelers	Hartford	12,492,250 00	49,951 78	32,720 02
Union Casualty and Surety	St. Louis	1,360,525 00	5,372 40	742 69

TABLE No. 12.

Showing the Business of Employers Liability Insurance Companies for the year 1900—California business.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.
Employers Liability	London			
Fidelity and Casualty	New York	$2,330,000 00	$17,160 47	$1,219 54
Frankfort Marine Accident and Plate Glass	Frankfort, Ger.	7,245,000 00	68,626 13	21,722 20
London Guarantee and Accident	London	1,450,000 00	16,009 34	894 85
Standard Life and Accident	Detroit	None.	None.	2,050 00
Maryland Casualty	Baltimore	1,136,000 00	20,266 34	3,413 46

TABLE No. 13.

Showing the Fidelity and Surety Business for the year 1900--California business.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.
American Bonding and Trust	Baltimore	$783,652 00	$3,792 28	None.
American Surety	New York	7,337,781 00	23,802 54	$19,856 44
City Trust, Safe Deposit, and Surety	Philadelphia	91,318 00	287 29	None.
Employers Liability	London			None.
Fidelity and Casualty	New York	1,085,400 00	3,534 00	None.
Fidelity and Deposit	Baltimore	17,868,999 00	53,736 26	3,060 35
National Surety	New York	17,428,236 00	40,919 88	3,974 73
Pacific Surety	San Francisco	10,681,499 00	40,711 36	863 98
U. S. Fidelity and Guaranty	Baltimore	5,906,919 00	21,677 50	15,474 30

TABLE No. 14.

Showing Plate Glass Insurance for the year 1900—California business.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.
Fidelity and Casualty	New York	$135,097 00	$2,058 18	$334 40
Frankfort Marine Accident and Plate Glass	Frankfort, Ger.	446,009 00	4,276 15	2,294 49
Lloyds Plate Glass	New York	----------	1,954 81	1,294 78
Maryland Casualty	Baltimore	31,345 00	1,285 56	143 64
Metropolitan Plate Glass	New York	131,739 00	2,849 77	1,492 57
New York Plate Glass	New York	456,343 00	5,624 33	3,998 57
Pacific Surety	San Francisco	84,258 00	2,527 75	601 86
Union Casualty and Surety	St. Louis	102,735 00	1,607 20	264 15
Totals		$1,387,526 00	$22,183 75	$10,424 46

TABLE No. 15.

Showing Steam Boiler Insurance for the year 1900—California business.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.
Fidelity and Casualty	New York	$904,000 00	$5,403 35	None.
Frankfort-American	New York	23,000 00	437 50	None.
Hartford Steam Boiler	Hartford	1,355,800 00	12,840 40	$713 59
Maryland Casualty	Baltimore	246,000 00	949 91	65 00
Pacific Surety	San Francisco	865,000 00	5,335 33	850 86
Totals		$3,393,800 00	$24,966 49	$1,629 45

TABLE No. 16.

Showing Burglary Insurance for the year 1900—California business.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.
Fidelity and Casualty	New York	$542,280 00	$4,724 47	$408 15

TABLE No. 17.

Showing Title Insurance for the year 1900—California business.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.
California Title Insurance and Trust	San Francisco	$6,524,695 00	$47,491 25	$301 42
Title Insurance and Trust	Los Angeles	1,288,064 00	4,491 50	936 41
Totals		$7,812,759 00	$51,982 75	$1,237 83

TABLE No. 18.

Showing Credit Indemnity Insurance for the year 1900—California business.

Name.	Location.	Amount Written.	Premiums on Same.	Losses Paid.
American Credit Indemnity	New York			
Ocean Accident and Guarantee	London	$44,000 00	$3,100 00	None.
Totals		$44,000 00	$3,100 00	None.

TABLE No. 19.

Showing the Business of Assessment Life and Sick Benefit Insurance Companies for the year 1900—California business.

Name.	Location.	New Policies Written.			Policies Renewed.			Policies in Force December 31, 1900.		Losses Paid.
		No.	Amount.	Annual Charges on Same.	No.	Amount.	Annual Charges on Same.	No.	Amount.	
Bankers Life Association	Des Moines	131	$262,000 00	$723 61	2,171	$4,342,000 00	$40,552 04	2,302	$4,604,000 00	$28,000 00
Decimal Mutual Life	San Francisco	1	1,000 00	20 00	21	21,000 00	324 00	22	22,000 00	None.
Fidelity Mutual Aid Ass'n.	San Francisco	2,873	3,020,000 00	52,070 00	1,053	1,028,000 00	19,530 04	1,790	1,882,500 00	10,313 12
Mutual Reserve Fund Life Association	New York									
Northwestern Life Ass'n.	Minneapolis	94	135,000 00	2,836 40	208	535,000 00	8,537 40	302	660,000 00	16,000 00
Pacific States Life	San Francisco	69	90,000 00	2,352 20	25	30,000 00	470 85	191	275,500 00	None.
Totals		3,168	$3,508,000 00	$58,002 21	3,428	$5,956,000 00	$69,414 33	4,607	$7,444,000 00	$54,313 12

TABLE NO. 20.

Showing year of organization, location, names of President, Secretary, and Agent or Attorney for California, and date of certificate of authority issued by Insurance Commissioner, and date of commencement of business in California, of all Insurance Companies authorized to transact business, on Dec. 31, 1900.

Year Organized.	Name.	Location.	President.	Secretary.	Agent for California.	Date of Certificate Issued by Insurance Commissioner.	Commenced Business in California.
1863	Fireman's Fund	San Francisco	Wm. J. Dutton	L. Weinmann		June 24, 1868	June 18, 1863
1864	Home Fire and Marine	San Francisco	Wm. J. Dutton	Stephen D. Ives		June 24, 1868	June 13, 1864
1900	Occidental	San Francisco	Wm. Mead	James H. Borland		May 23, 1900	May 23, 1900
1825	Aachen and Munich Fire	Aix-la-Chapelle	Weed & Kennedy, U. S.	Managers	Cesar Bertheau	April 21, 1893	April 21, 1893
1819	Ætna	Hartford	Wm. B. Clark	Wm. H. King	Boardman & Spencer	June, 1868	June 20, 1865
1853	Agricultural	Watertown, N. Y.	A. H. Sawyer	W. H. Stevens	Edw. Brown & Sons	Aug. 17, 1897	Aug. 2, 1876
1890	Alliance	Berlin	Carl Thieme	Paul Srelinski	Gutte & Frank	Dec. 22, 1892	Dec. 22, 1892
1824	Alliance	London	Weed & Kennedy, U. S.	Managers	C. F. Mullins	June 2, 1892	June 2, 1892
1824	Alliance Marine	London	Lord Rothschild	Douglas Owen	J. J. Moore & Co.	May 24, 1881	May 24, 1881
1846	American	Newark	E. O. Doremus	J. H. Worden	Christensen, Edwards & Goodwin	Aug. 14, 1896	Aug. 14, 1896
1818	American	Boston	Francis Peabody	H. S. Bean	Baggs & Stovel	Dec. 23, 1897	Dec. 23, 1897
1853	American Central	St. Louis	Geo. T. Cram	Jno. H. Adams	Chas. Christensen	April 15, 1874	April 15, 1874
1810	American Fire	Philadelphia	T. H. Montgomery	Rich'd Maris	Edw. Brown & Sons	Oct. 31, 1872	Oct. 31, 1872
1857	American Fire	New York	Geo. S. A. Young	W. S. Alley	Thos. J. Conroy	Sept. 16, 1899	Feb. 18, 1887
1896	American and Foreign Marine	New York	W. L. H. Simpson	J. E. Hoffman	Balfour, Guthrie & Co.	July 21, 1898	July 21, 1898
1897	Assurance Co. of America	New York	R. C. Rathbone	R. B. Rathbone	C. A. Henry & Co.	July 9, 1897	July 9, 1897
1808	Atlas	London	C. A. Prescott	S. J. Pipkin	F. J. Devlin	Aug. 15, 1885	Aug. 15, 1885
1864	Baloise	Basle	R. Iselin	T. Kaden	Syz & Co.	Nov. 28, 1876	Nov. 28, 1876
1863	Baloise Fire	Basle	Weed & Kennedy, U. S.	Managers	Syz & Co.	Dec. 30, 1890	Dec. 30, 1890
1873	Boston	Boston	R. B. Fuller	Tho. H. Lord	H. J. Knowles	Aug. 22, 1882	Aug. 22, 1882
1833	British America	Toronto	Geo. A. Cox	P. H. Sims	Watson & Taylor	Mar. 11, 1875	Mar. 11, 1875
1863	British and Foreign Marine	Liverpool	Richard Hobson	A. McNeil	Balfour, Guthrie & Co.	Oct. 10, 1868	Aug. 25, 1864
1805	Caledonian	Edinburgh	Chas. H. Post, U. S.	Manager	Thos. J. Conroy	July 24, 1885	July 24, 1885
1897	Caledonian American	New York	Chas. H. Post	N. A. McNeil	Thos. J. Conroy	Dec. 21, 1898	Dec. 21, 1898
1881	Canton	Hong Kong	J. J. Keswick	Geo. T. Veitch	Parrott & Co.	June 21, 1882	June 21, 1882
1865	China Traders	Hong Kong	A. Haupt	W. H. Ray	Williams, Dimond & Co.	Sept. 4, 1871	Sept. 4, 1871
1861	Commercial Union	London	A. H. Wray, U. S.	Manager	C. F. Mullins	June 22, 1870	June 22, 1870
1890	Commercial Union Fire	New York	A. H. Wray	C. J. Holman	C. F. Mullins	June 1, 1896	June 1, 1896
1852	Continental	New York	F. C. Moore	E. Lanning	J. D. Maxwell	Sept. 1, 1872	Sept. 1, 1872
1835	Delaware	Philadelphia	T. Paulding	H. Lylburn	Edw. Brown & Sons	May 3, 1900	May 3, 1900
1859	Equitable Fire and Marine	Providence	F. W. Arnold	J. E. Tillinghast	Wm. J. Dutton	June 28, 1890	June 28, 1890
1820	Fire Association	Philadelphia	E. C. Irvin	B. T. Herkness	J. M. Beck	Dec. 9, 1873	Dec. 9, 1873
1879	Fonciere	Paris	G. Robert	E. Seris	Mann & Wilson	Nov. 20, 1880	Nov. 20, 1880
1865	Frankfort Marine	Frankfort, Germany	F. Gerson	P. Dumcke	Voss, Conrad & Co.	June 26, 1890	June 26, 1890
1829	Franklin Fire	Philadelphia	J. W. McAllister	E. T. Cresson	E. E. Potter	May 15, 1885	May 15, 1885
1865	German	Freeport	C. O. Collmann	W. Trembor	C. H. Ward	Sept. 28, 1900	Sept. 28, 1900
1859	Germania Fire	New York	Hugo Schumann	C. Ruykhaver	W. H. Breeding	Aug. 29, 1900	Aug. 29, 1900
1897	German Alliance	New York	A. A. Strohn	C. G. Smith	Geo. H. Tyson	Mar. 8, 1897	Mar. 8, 1897
1872	German-American	New York	W. N. Kremer	C. G. Smith	Geo. H. Tyson	Oct. 10, 1873	Oct. 10, 1873
1853	Girard Fire and Marine	Philadelphia	A. S. Gillette	E. F. Merrill	G. W. McNear	Sept. 23, 1872	Sept. 23, 1872
1849	Glens Falls	Glens Falls	J. L. Cunningham	R. A. Little	E. E. Potter	Jan. 31, 1900	Jan. 31, 1900

1834	Greenwich	New York	M. A. Stone	W. B. Ward	Tom C. Grant	June 10, 1890	June 10, 1890
1854	Hamburg-Bremen	Hamburg	F. O. Affeld, U. S. Manager		R. Herold, Jr	Sept. 26, 1868	May 4, 1862
1852	Hanover Fire	New York	C. A. Shaw	J. McCord	Cesar Bertheau	Oct. 25, 1869	Oct. 25, 1869
1810	Hartford Fire	Hartford	Geo. L. Chase	P. C. Royce	H. K. Belden	Jan. 17, 1870	Jan. 17, 1870
1858	Helvetia General	St. Gall	F. Haltmayer	M. J. Grossmann	Syz & Co.	Nov. 26, 1876	Nov. 26, 1876
1861	Helvetia Swiss Fire	St. Gall	Weed & Kennedy, U. S. Managers		Syz & Co.	Dec. 6, 1876	Dec. 6, 1876
1853	Home	New York	J. H. Washburn	A. M. Burtis	Harry L. Roff	Nov. 13, 1868	Nov. 13, 1868
1803	Imperial	London	T. D. Belfield, U. S. Manager		Wm. J. Landers	Sept. 26, 1868	May 1, 1862
1893	Imperial Marine	Tokio	M. Takei		Macondray & Co.	June 20, 1898	June 20, 1898
1824	Indemnity Mutual Marine	London	J. N. Bullen	John T. Mainland	Evan C. Evans	Oct. 11, 1888	Oct. 11, 1888
1794	Ins. Co. of North America	Philadelphia	Chas. Platt	G. E. Fryer	Jas. D. Bailey	Oct. 11, 1872	Oct. 11, 1872
1794	Ins. Co. of the State of Penn.	Philadelphia	G. G. Crowell	A. B. Earle	W. J Dutton	Feb. 15, 1878	Feb. 15, 1878
1858	Kings County Fire	New York	Frank Lock	C. J. Wolf	Frank J. Devlin	Oct. 11, 1899	Oct. 11, 1899
1852	Lancashire	Manchester	M. Dargan, U. S. Manager		Mann & Wilson	July 10, 1874	July 10, 1874
1825	Law, Union, and Crown	London	Hall & Henshaw, U. S. Managers		Catton, Bell & Co.	July 13, 1898	July 13, 1898
1879	Lion Fire	London	Jas. H. Brewster, U. S. Manager		Wm. J. Landers	April 12, 1880	April 12, 1880
1836	Liverpool and London and Globe	Liverpool	H. W. Eaton, U. S. Manager		Chas. D. Haven	Sept. 26, 1868	May 1, 1862
1720	London	London	Chas. L. Case, U. S. Manager		Geo. F. Grant	Aug. 28, 1872	Aug. 28, 1872
1861	London and Lancashire Fire	Liverpool	A. G. McIlwaine, Jr., U. S. Manager		Wm. Macdonald	Nov. 6, 1879	Nov. 6, 1879
1860	London and Provincial Marine	London	F. W. Lunau	H. S. B. Cooley	Girvin Eyre	April 3, 1879	April 3, 1879
1844	Magdeburg Fire	Magdeburg	H. Vatke	R. Berndt	Gutte & Frank	Sept. 6, 1886	Sept. 6, 1886
1897	Magdeburg Fire	New York	E. F. Miethke	A. Dohmeyer	Gutte & Frank	May 24, 1898	May 24, 1898
1824	Manchester Fire	Manchester	G. S. A. Young, U. S. Manager		Thos. J. Conroy	April 22, 1880	April 22, 1880
1869	Manhattan Fire	New York	Daniel Myers	J. W. Durbrow	F. J. Fallon	Dec. 14, 1900	Dec. 14, 1900
1879	Mannheim	Mannheim	F. Hermann, U. S. Manager		Beede & Le Boyteau	Nov. 10, 1884	Nov. 10, 1884
1881	Man On	Hong Kong	Ko Shun Kam	Chan Sin Ki	Wing Tuck & Co.	Oct. 31, 1881	Oct. 31, 1881
1836	Marine	London	A. J. Chatfield	H. G. R. Maughan	G. W. McNear	Sept. 11, 1877	Sept. 11, 1877
1864	Maritime	Liverpool	Thos. Comber	J. C. Nicholson	Livingston, Smith & Co.	July 3, 1874	July 3, 1874
1823	Mercantile Fire and Marine	Boston	Geo. R. Rogers	Jas. Simpson	Christensen, Edwards & Goodwin	Mar. 3, 1898	Mar. 3, 1898
1858	Merchants	Newark	G. Lee Stout	W. H. Guerin	G. W. McNear	Jan. 1, 1882	Jan. 1, 1882
1852	Milwaukee Mechanics	Milwaukee	Wm. L. Jones	G. W Grossenbach	L. L. Bromwell	April 12, 1894	April 12, 1894
1871	National Fire	Hartford	Jas. Nichols	B. R. Stillman	Geo. D. Dornin	Aug. 5, 1884	Aug. 5, 1884
1896	National Standard	New York	J. F. Freeman	E. E. Pieper	C. A. Henry & Co.	July 9, 1897	July 9, 1897
1845	Netherlands Fire	The Hague	Weed & Kennedy, U. S. Managers		Wm. Macdonald	Jan. 2, 1900	Jan. 2, 1900
1869	New Hampshire Fire	Manchester	M. C. Crosby	F. W. Sargeant	H. Folger	May 2, 1900	May 2, 1900
1859	New Zealand	Auckland	W. P. Thomas, U. S. Manager		W. P. Thomas	Mar. 27, 1875	Mar. 27, 1875
1850	Niagara Fire	New York	H. Herrick	Geo. W. Dewey	W. Y. Loaiza	Oct. 18, 1878	Oct. 18, 1878
1809	North British and Mercantile	London	W. T. Price	F. W. Lance	Tom C. Grant	Sept. 26, 1868	Oct. 13, 1862
1863	North China	Shanghai	W. Meyerink	W. G. Bayne	Macondray & Co.	June 13, 1876	June 13, 1876
1836	Northern	London	E. Chaplin	H. E. Wilson	Geo. F. Grant	Sept. 26, 1868	May 1, 1862
1868	North German Fire	Hamburg	A. Loeb, U. S. Manager		Walter Speyer	Sept. 20, 1877	Sept. 20, 1877
1899	North German Fire	New York	C. Perger	E. Harbers	Walter Speyer	June 8, 1899	June 8, 1899
1869	Northwestern National	Milwaukee	Alfred James	W. D. Reed	G. W. Turner	Feb. 27, 1889	Feb. 27, 1889
1797	Norwich Union Fire	Norwich	F. A. Cubitt	C. A. B. Bignold	W. H. Lowden	July 13, 1877	July 13, 1877
1859	Ocean Marine	London	H. J. Jourdain	Alfred Price	H. M. Newhall & Co.	June 20, 1890	June 20, 1890
1867	Orient	Hartford	A. G. McIlwaine, Jr.	James Dyper	Wm. Macdonald	Mar. 10, 1891	Mar. 10, 1891
1900	Palatine	London	A. H. Wray, U. S. Manager		C. F. Mullins	Dec. 31, 1900	Dec. 31, 1900
1899	Pelican	New York	A. D. Irving	A. D. Irving, Jr.	Butler & Hewitt	May 17, 1899	May 17, 1899
1825	Pennsylvania Fire	Philadelphia	R. D. Benson	W. G. Crowell	T. Edw. Pope	Dec. 20, 1875	Dec. 20, 1875
1853	Phenix	Brooklyn	Geo. P. Sheldon	W. A. Wright	H. M. Spencer	Nov. 9, 1868	Aug. 25, 1864
1854	Phœnix	Hartford	D. W. C. Skilton	E. Milligan	H. Folger	July 16, 1868	June 29, 1863
1782	Phœnix	London	A. D. Irving, U. S. Manager		Butler & Hewitt	Dec. 22, 1879	Dec. 22, 1879
1895	Po On	Hong Kong	Chu Shan Chi	Un Lai Chuen	Lui Mon	Dec. 11, 1896	Dec. 11, 1896

TABLE No. 20—Continued.

Year Organized	Name	Location	President	Secretary	Agent for California	Date of Certificate Issued by Insurance Commissioner	Commenced Business in California
1799	Providence Washington	Providence	J. H. De Wolf	E. H. Watson	Butler & Hewitt	Dec. 31, 1874	Dec. 31, 1874
1845	Prussian National	Stettin	Theo. W. Letton, U. S.	Manager	W. Y. Loaiza	Nov. 16, 1891	Nov. 16, 1891
1891	Queen	New York	E. F. Beddall	N. B. Barlow	Rolla V. Watt	Oct. 12, 1891	Oct. 12, 1891
1881	Reliance Marine	Liverpool	W. Blain	W. B. Broadbent	Henry Lund & Co.	Dec. 10, 1891	Dec. 10, 1891
1845	Royal	Liverpool	E. F. Beddall, U. S. Manager		Rolla V. Watt	June 21, 1880	June 21, 1880
1720	Royal Exchange	London	H. F. Tiarks	W. N. Whymper	F. W. Dickson	May 20, 1891	May 20, 1891
1824	Scottish Union and National	Edinburgh	Jas. H. Brewster, U. S.	Manager	T. J. A. Tiedemann	July 10, 1891	July 10, 1891
1875	Sea	Liverpool	Geo. Gilmour	W. A. Edwards	Meyer, Wilson & Co.	July 10, 1876	July 10, 1876
1849	Springfield Fire and Marine	Springfield, Mass.	A. W. Damon	W. J. Mackay	Geo. D. Dornin	April 6, 1891	April 6, 1891
1871	Standard Marine	Liverpool	J. Williamson	John Glek	J. D. Spreckels & Bro.	June 23, 1891	June 23, 1891
1891	State Fire	Liverpool	Hall & Henshaw, U. S.	Managers	W. Macdonald	Nov. 1, 1890	Nov. 1, 1890
1865	St. Paul Fire and Marine	St. Paul	C. H. Bigelow	A. W. Perry	C. Christensen	Sept. 23, 1872	Sept. 23, 1872
1710	Sun	London	J. J. Guile, U. S. Manager		C. A. Henry & Co.	Feb. 26, 1886	Feb. 26, 1886
1866	Svea	Gothenburg	O. Wijk	E. Bring	Edw. Brown & Sons	Sept. 22, 1884	Sept. 22, 1884
1869	Switzerland Marine	Zurich	R. Naef	H. Knorr	Syz & Co.	Oct. 7, 1874	Oct. 7, 1874
1871	Teutonia	New Orleans	Albert Noll	Geo. Meyer	Mann & Wilson	April 18, 1879	April 18, 1879
1860	Thames and Mersey	Liverpool	H. W. Bird	J. Kidman	W. G. Harrison	Aug. 21, 1878	Aug. 21, 1878
1853	Thuringia	Erfurt	M. Ludewig	Ernst Lange	Voss, Conrad & Co.	Nov. 10, 1886	Nov. 10, 1886
1865	Traders	Chicago	E. Buckingham	S. A. Rothermel	Gordon & Fraser	June 6, 1873	June 6, 1873
1872	Transatlantic Fire	Hamburg	Adolph Loeb, U. S. Manager		A. C. Driffield	Aug. 2, 1877	Aug. 2, 1877
1804	Union	Philadelphia	C. S. Hollinshead	E. R. Dannels	T. Edw. Pope	Oct. 11, 1880	Oct. 11, 1880
1714	Union	London	Hall & Henshaw, U. S.	Managers	Catton, Bell & Co.	May 20, 1880	May 20, 1880
1863	Union Marine	Liverpool	T. B. Royden	J. S. Allen	E. L. Woods	July 3, 1874	July 3, 1874
1824	United States Fire	New York	W. W. Underhill	S. M. Craft	G. W. McNear	Feb. 27, 1890	Feb. 27, 1890
1880	Universo Marine	Milan, Italy	F. Bertarelli	C. Vuilliomenet	Mann & Wilson	Nov. 27, 1890	Nov. 27, 1890
1898	Victoria Fire	New York	H. H. Hall	E. K. Boddall	Catton, Bell & Co.	Mar. 14, 1900	Mar. 14, 1900
1837	Westchester Fire	New York	G. R. Crawford	M. O. Brown	G. M. Mitchell	Mar. 20, 1895	Mar. 20, 1895
1851	Western	Toronto	Geo. A. Cox	C. C. Foster	Watson & Taylor	Jan. 12, 1877	Jan. 12, 1877
1872	Wilhelma	Magdeburg		T. Dammann	Gutte & Frank	Aug. 31, 1878	Aug. 31, 1878
1853	Williamsburgh City Fire	Brooklyn	M. S. Driggs	F. H. Way	E. E. Potter	Feb. 12, 1881	Feb. 12, 1881
1862	Yangtsze	Shanghai	Jas. M. Young	W. S. Jackson	Balfour, Guthrie & Co.	Oct. 23, 1889	Sept. 11, 1866
1820	Ætna Life	Hartford	M. G. Bulkeley	J. L. English	H. B. Houghton	Mar. 12, 1879	Mar. 12, 1879
1846	Connecticut Mutual Life	Hartford	J. L. Greene	H. H. White	A. K. P. Harmon	June 21, 1880	June 21, 1880
1900	Conservative Life	Los Angeles	D. W. Edwards	Milo Baker		July 5, 1900	July 5, 1900
1859	Equitable Life	New York	Jas. W. Alexander	Wm. Alexander	A. M. Shields	July 9, 1878	July 9, 1878
1878	Fidelity Mutual Life	Philadelphia	L. G. Fouse	W. S. Campbell	G. A. Rathbun	April 27, 1900	April 27, 1900
1860	Germania Life	New York	C. Doremus	H. Cillis	W. A. Jacobs	Feb. 11, 1879	Feb. 11, 1879
1860	Home Life	New York	George E. Ide	E. W. Gladwin	W. H. Dunphy	Oct. 11, 1887	Oct. 11, 1887
1850	Manhattan Life	New York	H. B. Stokes	J. H. Giffin	John Landers	Aug. 2, 1878	Aug. 2, 1878
1851	Massachusetts Mutual Life	Springfield	John A. Hall	H. M. Phillips	C. M. T. Parker	May 20, 1891	May 20, 1891
1842	Mutual Life	New York	R. A. McCurdy	W. J. Easton	A. B. Forbes	July 1, 1878	July 1, 1878
1845	Mutual Benefit Life	Newark	Amzi Dodd	E. L. Dobbins	James Munsell, Jr.	Sept. 7, 1880	Sept. 7, 1880
1848	National Life	Montpelier	James C. Houghton	O. D. Clark	G. M. Stolp & Son	June 21, 1880	June 21, 1886
1835	New England Mutual Life	Boston	B. F. Stevens	S. F. Trull	H. K. Field	Sept. 26, 1868	June 17, 1867

1841	New York Life	New York	John A. McCall	C. C. Whitney	Chas. A. McLane	Aug. 20, 1878	Aug. 20, 1878
1857	Northwestern Mutual Life	Milwaukee	H. L. Palmer	J. W. Skinner	C. M. Smith	May 31, 1882	May 31, 1882
1867	Pacific Mutual Life	San Francisco	Geo. A. Moore	S. M. Marks		June 24, 1868	Jan. 2, 1868
1847	Penn Mutual Life	Philadelphia	H. F. West	H. C. Brown	E. H. Hart	Feb. 24, 1888	Feb. 24, 1888
1851	Phœnix Mutual Life	Hartford	J. B. Bunce	C. H. Laurence	J. W. Hicks	Aug. 20, 1880	Aug 20, 1880
1875	Provident Savings Life	New York	E. W. Scott	W. E. Stevens	C. C. Gross	Oct. 17, 1888	Oct. 17, 1888
1895	Security Trust and Life	Philadelphia	R. E. Pattison	E S. Bartlett	M. J. Green	Sept. 11, 1899	Sept. 11, 1899
1863	Travelers	Hartford	J. G. Batterson	J. E. Morris	W. W. Haskell	July 19, 1878	July 19, 1878
1867	Union Central Life	Cincinnati	J. M. Pattison	E. P. Marshall	Chas. W. Mills	Feb. 25, 1885	Feb. 25, 1885
1848	Union Mutual Life	Portland	F. E. Richards	J. Frank Lang	W. C. Leavitt	Sept. 11, 1868	Sept. 11, 1868
1860	Washington Life	New York	W. A. Brewer, Jr.	G. H. Brewer	H. Perrin	Feb. 5, 1881	Feb. 5, 1881
1879	Bankers Life Association	Des Moines	E. A. Temple	A. C. Stilson	G. F. Wink	July 10, 1891	July 10, 1891
1898	Decimal Mutual Life	San Francisco	W. H. Busch	W. S. Pardy		Nov. 10, 1898	Nov. 10, 1898
1888	Fidelity Mutual Aid Ass'n	San Francisco	C. W. Nevin	J. L. M. Shetterley		May 15, 1891	May 15, 1891
1898	Humboldt County Fire	Ferndale	E. C. Damon	N. J. Peterson		Sept. 6, 1898	Sept. 6, 1898
1899	Los Angeles Co. Mutual Fire	Los Angeles	A. T. Currier	G. F. Cromer		Sept. 6, 1899	Sept. 6, 1899
1897	Mutual Fire	Paso Robles	M. Gerst	S. D. Merk		July 10, 1897	July 10, 1897
1898	Orange Co. Farmers Mutual Fire	Santa Ana	W. A. Beckett	F. D. Reed		June 11, 1898	June 11, 1898
1899	San Bernardino Co. Mutual Fire	Ontario	P. E. Walline	W. S. Mitchell		July 10, 1899	July 10, 1899
1900	Santa Clara County Fire	San José	S. P. Sanders	Jos. Taylor		June 22, 1900	June 22, 1900
1899	Scandinavian Mut'l Prot. Fire	Kingsburg	A. Hallner	N. G. Nelson		July 12, 1899	July 12, 1899
1898	Sonoma Co. Farmers Mut'l Fire	Santa Rosa	S. T. Coulter	H. Gregory		Jan. 13, 1898	Jan. 13, 1898
1898	Ventura County Mutual Fire	Ventura	E. P. Foster	C. Barnard		May 10, 1898	May 10, 1898
1897	Ætna Indemnity	Hartford	F. T. Maxwell	E. S. Pegram	H. B. Houghton	Aug. 24, 1898	Aug. 24, 1898
1895	American Bonding & Trust	Baltimore	Jas. Bond	S. H. Shriver	E. F. Green	Feb. 6, 1900	Feb. 6, 1900
1893	American Credit Indemnity	New York	S. M. Phelan	E. M. Treat	G J. Steinsdorff	Feb. 15, 1897	Feb. 15, 1897
1884	American Surety	New York	H. D. Lyman	C. M. Sweney	C. A. Shurtleff	Dec. 5, 1884	Dec. 5, 1884
1886	California Title Ins. & Trust	San Francisco	H. L. Davis	C. M. Keeney		March 11, 1887	March 11, 1887
1886	City Trust, Safe Deposit, & Su'ty	Philadelphia	C. M. Swain	Jas. F. Lynd	E. E. Potter	June 9, 1896	June 9, 1896
1880	Employers Liability	London	S. Appleton, U. S. Manager		C. J. O'Kell	June 20, 1887	June 20, 1887
1876	Fidelity and Casualty	New York	G. F. Seward	R. J. Hillas	S. J. Pardee	Mar. 4, 1881	Mar. 4, 1881
1890	Fidelity and Deposit	Baltimore	E. Warfield	H. E. Bosler	F. L. Gilbert	June 25, 1894	June 25, 1894
1898	Frankfort American	New York	P. Dumcke	G. Macdonald	Voss, Conrad & Co.	Aug. 29, 1898	Aug. 29, 1898
1866	Hartford Steam Boiler	Hartford	J. M. Allen	J. B. Pierce	Mann & Wilson	Nov. 6, 1884	Nov. 6, 1884
1882	Lloyds Plate Glass	New York	W. T. Woods	C. E. W. Chambers	C. Christensen	Dec. 6, 1887	Dec. 6, 1887
1869	London Guarantee and Accid'nt	London	A. W. Masters, U. S. Manager		E. C. Landis	Oct. 17, 1892	Oct. 17, 1892
1898	Maryland Casualty	Baltimore	John T. Stone	W. E. Thomsen	F. W. Voogt	Dec. 6, 1898	Dec. 6, 1898
1874	Metropolitan Plate Glass	New York	E. H. Winslow	S. W. Burton	Mann & Wilson	May 8, 1879	May 8, 1879
1897	National Surety	New York	Chas. A. Dean	B. McCall	Jas. H. Borland	July 20, 1894	July 20, 1894
1891	New York Plate Glass	New York	M. Danziger	Major A. White	J. D. Maxwell	May 6, 1891	May 6, 1891
1886	North American Accident	Chicago	E. E. Crepin	A. E. Forrest	W. A. Mathews	July 6, 1900	July 6, 1900
1895	Ocean Accident and Guarantee	London	Oscar Ising, U. S. Manager		Sidney Loth	Dec. 22, 1898	Dec. 22, 1898
1885	Pacific Surety	San Francisco	W. Everson	A. P. Redding		Aug. 4, 1885	Aug. 4, 1885
1893	Preferred Accident	New York	P. C. Lounsbury	K. C. Atwood	Tho. Godwin	June 12, 1893	June 12, 1893
1884	Standard Life and Accident	Detroit	D. M. Ferry	E. A. Leonard	C. F. Briggs	Nov. 12, 1894	Nov. 12, 1894
1893	Title Insurance and Trust	Los Angeles	W. H. Allen, Jr.	O. P. Clark		Nov. 25, 1895	Nov. 25, 1895
1892	Union Casualty and Surety	St. Louis	Edw. Cluff	L. L. Atwood	W. Y. Loaiza	Sept. 2, 1893	Sept. 2, 1893
1896	U. S. Fidelity and Guaranty	Baltimore	J. R. Bland	G. R. Callis	Robertson & Nippert	June 10, 1897	June 10, 1897

TABLE NO. 21.

Showing the Assets, Liabilities, Incomes, Expenditures, Etc., of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—California Companies.

Name.	Location.	Cash Capital Paid Up.	Assets.	Liabilities, Capital Not Included.	Incomes.	Expenditures.	Losses Incurred during the Year.	Net Surplus.
Firemen's Fund	San Francisco	$1,000,000 00	$4,013,675 76	$1,671,807 61	$2,098,676 00	$2,059,209 14	$1,191,457 64	$1,341,868 15
Home Fire and Marine	San Francisco	300,000 00	1,037,715 39	412,571 45	560,070 20	514,329 46	310,672 59	325,143 94
Totals		$1,300,000 00	$5,051,391 15	$2,084,379 06	$2,658,746 20	$2,573,538 60	$1,502,130 23	$1,667,012 09

TABLE NO. 22.

Showing the various items composing the Assets of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—California Companies.

Name.	Location.	Real Estate.	Mortgage Loans.	Stocks and Bonds Owned.	Collateral Loans.	Cash in Office and Banks.	Interest Due and Accrued.	Premiums in Course of Collection.	All Other Assets.	Total Assets.
Firemen's Fund	San Francisco	$563,700 00	$280,187 64	$2,262,825 00	$181,100 00	$190,504 50	$7,703 64	$511,719 52	$15,935 46	$4,013,675 76
Home Fire & Marine	San Francisco	234,250 00	239,919 00	327,523 00	45,500 00	78,343 21	4,023 95	108,156 23	------	1,037,715 39
Totals		$797,950 00	$520,106 64	$2,590,348 00	$226,600 00	$268,847 71	$11,727 59	$619,875 75	$15,935 46	$5,051,391 15

TABLE NO. 23.

Showing the various items composing the Liabilities, except Capital Stock, of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—California Companies.

Name.	Location.	Losses Adjusted.	Losses Unadjusted.	Losses Resisted.	Fire Reinsurance.	Marine Reinsurance.	All Other Claims.	Total Liabilities.	Net Surplus.
Fireman's Fund	San Francisco	$32,093 30	$138,775 92	$5,825 00	$1,321,015 24	$92,272 94	$81,825 21	$1,671,807 61	$1,341,868 15
Home Fire and Marine	San Francisco	1,779 54	32,710 77	----------	332,746 44	28,860 30	16,474 40	412,571 45	325,143 94
Totals		$33,872 84	$171,486 69	$5,825 00	$1,653,761 68	$121,133 24	$98,299 61	$2,084,379 06	$1,667,012 09

TABLE NO. 24.

Showing the various items composing the Incomes of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—California Companies.

Name.	Location.	Fire Premiums.	Marine Premiums.	Interest on Mortgages.	Interest from Other Sources.	Rents.	All Other Sources.	Total Incomes.
Fireman's Fund	San Francisco	$1,597,492 63	$323,183 05	$32,609 15	$117,439 08	$27,952 09	----------	$2,098,676 00
Home Fire and Marine	San Francisco	426,218 86	90,525 65	15,706 28	17,662 19	9,957 22	----------	560,070 20
Totals	----------	$2,023,711 49	$413,708 70	$48,315 43	$135,101 27	$37,909 31	----------	$2,658,746 20

TABLE NO. 25.

Showing the various items composing the Expenditures of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—California Companies.

Name.	Location.	Fire Losses.	Marine Losses.	Dividends.	Commissions and Brokerage.	Office Salaries.	Taxes.	All Other Expenditures.	Total Expenditures.
Fireman's Fund	San Francisco	$988,951 74	$197,496 85	$120,000 00	$257,301 45	$236,017 74	$68,432 45	$191,008 91	$2,059,209 14
Home Fire and Marine	San Francisco	234,900 32	55,803 67	36,000 00	78,394 00	66,546 04	12,744 50	29,940 93	514,329 46
Totals	----------	$1,223,852 06	$253,300 52	$156,000 00	$335,695 45	$302,563 78	$81,176 95	$220,949 84	$2,573,538 60

TABLE No. 26.

Showing amount of Risks Written, Premiums Received, and amount of Risks in Force on December 31, 1900, with Premiums thereon, of Fire and Fire and Marine Insurance Companies doing business in California--California Companies.

Name.	Location.	RISKS WRITTEN DURING THE YEAR.				
		Fire.	Premiums.	Marine.	Premiums.	Total Premiums.
Fireman's Fund	San Francisco	$192,755,941 00	$2,316,597 26	$101,564,872 00	$862,050 30	$3,178,647 56
Home Fire and Marine	San Francisco	45,830,616 00	595,461 57	12,158,696 00	106,638 29	702,099 86
Totals		$238,586,557 00	$2,912,058 83	$113,723,568 00	$968,688 59	$3,880,747 42

Name.	Location.	RISKS IN FORCE DECEMBER 31, 1900.				
		Fire.	Premiums.	Marine.	Premiums.	Total Premiums.
Fireman's Fund	San Francisco	$217,250,396 00	$2,616,972 28	$4,530,425 00	$161,180 42	$2,778,152 70
Home Fire and Marine	San Francisco	52,073,074 00	670,507 94	1,931,430 00	50,598 94	721,106 88
Totals		$269,323,470 00	$3,287,480 22	$6,461,855 00	$211,779 36	$3,499,259 58

TABLE No. 27.

Summary of Assets, Liabilities, Incomes, Expenditures, etc., and amount of Surplus over Capital Stock, of Fire and Fire and Marine Insurance Companies doing business in California, on December 31, 1900—Companies of other States.

Name.	Location.	Cash Capital Paid Up.	Assets.	Liabilities, Capital Not Included.	Incomes.	Expenditures.	Losses Incurred During the Year.	Net Surplus.
Ætna	Hartford	$4,000,000 00	$13,357,293 72	$4,143,691 82	$4,762,208 66	$4,798,739 17	$2,622,525 00	$5,213,601 90
Agricultural	Watertown, N.Y.	500,000 00	2,223,536 35	1,174,995 80	1,025,088 38	1,046,642 40	570,430 00	548,540 55
American	Newark	600,000 00	3,673,483 46	1,473,691 31	1,170,537 44	1,098,611 91	582,257 50	1,599,792 15
American	Boston	300,000 00	624,633 51	209,431 48	234,431 54	251,456 50	123,531 42	115,202 03
American Central	St Louis	600,000 00	2,019,566 75	793,674 68	943,386 35	941,979 29	498,355 95	625,892 07
American Fire	Philadelphia	500,000 00	2,477,069 00	1,729,708 58	1,433,708 98	1,606,216 07	943,455 96	247,360 42
American Fire	New York	400,000 00	1,478,229 12	766,020 57	984,403 52	1,036,719 34	664,825 10	312,208 55
Assurance Co. of America	New York	200,000 00	520,988 54	191,109 74	243,153 88	292,202 23	156,760 72	129,878 80
Caledonian American	New York	200,000 00	372,546 29	99,977 33	116,960 17	117,066 10	78,253 58	72,568 96
Commercial Union Fire	New York	200,000 00	343,418 17	120,186 40	123,408 90	132,930 09	90,524 01	23,231 77
Continental	New York	1,000,000 00	10,638,271 47	5,127,732 17	4,667,620 36	4,044,922 58	2,267,563 19	4,510,539 30
Delaware	Philadelphia	702,875 00	1,507,201 67	699,549 30	761,696 68	842,344 64	475,730 00	104,777 37

Equitable Fire and Marine	Providence, R. I.	400,000 00	918,503 18	388,422 32	499,314 27	488,932 29	292,149 23	130,080 86
Fire Association	Philadelphia	500,000 00	6,340,250 99	4,914,201 82	3,181,977 59	3,189,220 92	1,797,230 55	926,049 17
Franklin Fire	Philadelphia	400,000 00	3,083,799 30	1,589,513 07	634,495 96	649,438 64	329,837 60	1,094,286 23
German	Freeport, Ill.	200,000 00	3,714,904 52	2,239,682 82	1,924,409 62	1,717,612 63	894,776 15	1,275,221 70
German Alliance	New York	400,000 00	1,015,236 11	274,451 82	312,924 55	283,094 29	188,894 55	340,784 29
German-American	New York	1,000,000 00	8,676,281 34	3,408,569 64	3,308,035 69	3,129,536 19	1,745,321 43	4,267,711 70
Germania Fire	New York	1 000,000 00	4,963,800 48	1,687,825 10	1,355,577 24	1,303,839 10	643,281 15	2,275,975 38
Girard Fire and Marine	Philadelphia	300,000 00	2,070,496 90	1,102,385 95	489,099 90	553,878 38	278,625 90	668,110 95
Glens Falls	Glens Falls, N.Y.	200,000 00	3,436,899 05	1,009,708 96	1,018,290 87	891,066 67	452,074 03	2,227,190 09
Greenwich	New York	200,000 00	1,903,272 46	1,540,212 55	1,526,557 10	1,522,911 83	857,565 83	163,059 91
Hanover Fire	New York	1,000,000 00	3,108,305 70	1,622,642 40	1,862,923 05	1,931,934 28	1,178,023 60	485,663 30
Hartford Fire	Hartford	1,250,000 00	10,979,255 03	6,206,495 12	7,072,934 65	7,286,650 11	5,012,539 63	3,522,759 91
Home	New York	3,000,000 00	13,637,833 53	5,397,061 19	5,456,895 14	4,951,722 57	2,840,915 77	5,240,772 34
Ins. Co. of North America	Philadelphia	3,000,000 00	9,532,263 36	4,931,564 35	6,458,267 23	6,114,527 35	3,874,631 52	1,600,699 01
Ins. Co. of the State of Penn.	Philadelphia	200,000 00	539,817 28	287,391 78	254,593 70	374,167 79	188,064 28	52,425 50
Kings County Fire	New York	200,000 00	371,086 68	77,370 99	136,119 08	124,245 28	61,241 65	93,715 69
Magdeburg Fire	New York	200,000 00	291,642 03	50,338 01	75,838 89	72,981 11	39,916 91	41,304 02
Manhattan Fire	New York	500,000 00	853,092 70	315,079 15	638,496 03	830,446 42	545,694 14	38,013 55
Mercantile Fire and Marine	Boston	400,000 00	573,114 87	148,767 65	182,099 79	204,378 44	101,726 00	24,347 22
Merchants	Newark	400,000 00	1,388,706 08	805,570 73	898,145 54	1,098,889 64	653,343 78	183,135 35
Milwaukee Mechanics	Milwaukee	200,000 00	2,519,913 90	964,561 62	1,028,093 39	1,014,882 30	521,379 10	1,355,352 28
National Fire	Hartford	1,000,000 00	4,992,692 38	2,458,812 67	2,932,478 80	2,745,819 89	1,561,517 06	1,533,879 71
National Standard	New York	200,000 00	549,310 50	193,616 65	277,921 77	291,022 71	157,835 61	155,693 85
New Hampshire Fire	Manchester	1,000,000 00	3,414,920 13	1,411,665 10	1,469,980 87	1,471,294 47	851,876 01	1,003,255 03
Niagara Fire	New York	500,000 00	2,899,390 06	1,587,554 85	1,759,296 89	1,740,074 17	1,035,402 18	811,835 21
North German Fire	New York	200,000 00	305,571 00	74,078 99	114,175 65	86,755 88	47,367 87	31,492 01
Northwestern National	Milwaukee	600,000 00	2,955,139 20	1,362,841 72	1,155,947 25	976,083 30	460,638 40	992,297 48
Orient	Hartford	500,000 00	2,379,038 33	1,214,996 97	1,342,432 95	1,451,711 76	976,341 97	664,041 36
Pelican	New York	200,000 00	387,315 06	104,054 06	142,874 27	116,516 57	72,186 94	83,261 00
Pennsylvania Fire	Philadelphia	400,000 00	5,337,222 43	2,775,038 56	2,133,286 09	2,053,489 12	1,258,714 30	2,162,183 87
Phenix	Brooklyn	1,000,000 00	5,994,704 88	3,460,925 24	3,436,468 19	3,433,483 42	1,965,864 06	1,533,779 64
Phœnix	Hartford	2,000,000 00	5,583,494 25	2,340,944 32	2,991,045 46	3,087,589 92	1,731,154 00	1,242,549 93
Providence-Washington	Providence, R.I.	500,000 00	2,122,297 43	1,121,864 96	1,553,878 49	1,535,651 64	1,006,688 96	500,432 47
Queen	New York	500,000 00	4,751,381 76	1,902,177 90	2,104,714 28	2,045,481 36	1,257,001 68	2,349,203 86
Springfield Fire and Marine	Springfield, Mass.	1,500,000 00	5,159,623 47	1,840,480 06	2,129,421 21	2,064,462 75	1,162,469 94	1,819,143 41
St. Paul Fire and Marine	St. Paul	500,000 00	2,606,392 12	1,453,738 11	1,934,740 52	1,784,558 59	1,042,949 47	652,654 01
Teutonia	New Orleans	250,000 00	721,210 63	280,661 97	497,401 43	497,780 78	308,511 00	190,548 66
Traders	Chicago	500,000 00	2,432,197 10	920,299 04	1,184,816 47	1,128,029 17	659,194 02	1,011,898 06
Union	Philadelphia	200,000 00	545,119 78	289,582 94	298,387 65	344,128 01	183,317 75	55,536 84
Victoria Fire	New York	200,000 00	255,808 87	50,841 78	97,845 27	108,658 64	68,279 76	4,967 09
United States Fire	New York	250,000 00	743,805 17	369,705 28	377,664 92	371,030 60	186,916 62	124,099 89
Westchester Fire	New York	300,000 00	2,942,761 04	1,423,502 68	1,650,658 03	1,564,564 53	895,128 28	1,219,258 36
Williamsburg City Fire	Brooklyn	250,000 00	2,066,299 68	695,405 06	726,212 71	733,566 45	365,020 73	1,120,894 62
Totals		$36,702,875 00	$178,300,408 81	$82,824,375 13	$85,093,343 31	$83,575,940 28	$48,825,821 84	$58,773,158 68

TABLE No. 28.

Showing the various items composing the Assets of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—Companies of other States.

Name.	Location.	Real Estate.	Loans on Bonds and Mortgages.	Stocks and Bonds Owned by the Company.	Loans on Stocks and Other Collateral Securities.	Cash in Office and in Banks.
Ætna	Hartford	$230,000 00	$15,600 00	$11,740,821 12	$3,600 00	$805,816 25
Agricultural	Watertown, N. Y.	342,915 00	784,659 26	610,172 50	181,821 27	124,528 49
American	Newark	238,972 96	1,730,226 75	1,358,020 00		52,143 00
American	Boston			553,866 50		21,181 75
American Central	St. Louis	500,000 00	7,703 45	1,260,160 00	25,000 00	90,605 74
American Fire	Philadelphia	404,379 50	936,475 55	807,710 25	3,800 00	148,408 80
American Fire	New York			1,089,175 00		102,685 90
Assurance Company of America	New York			434,306 15		30,590 80
Caledonian American	New York			331,975 00		10,295 25
Commercial Union Fire	New York			279,552 50		17,505 74
Continental	New York	1,106,250 00	60,210 00	8,085,880 00		638,413 83
Delaware	Philadelphia	162,500 00	128,700 00	880,896 00	50,000 00	157,667 14
Equitable Fire and Marine	Providence, R. I.	125,000 00	145,950 00	458,840 00	50,000 00	50,235 32
Fire Association	Philadelphia	493,600 00	1,506,810 89	3,072,426 00	85,140 61	256,185 49
Franklin Fire	Philadelphia	232,500 00	133,858 00	2,493,062 00	54,500 00	95,859 53
German	Freeport, Ill.	79,348 25	1,558,980 15	1,357,812 44	13,300 00	268,466 83
German Alliance	New York			911,280 00		26,642 94
German-American	New York	15,000 00	13,000 00	7,701,467 00		360,404 35
Germania Fire	New York	686,824 27	378,500 00	3,480,614 00		164,527 31
Girard Fire and Marine	Philadelphia	382,000 00	634,700 00	738,973 00	95,780 00	61,687 15
Glens Falls	Glens Falls, N. Y.	62,700 00	1,120,386 66	1,693,145 25	4,000 00	423,377 07
Greenwich	New York	300,000 00		1,254,450 00		41,507 51
Hanover Fire	New York	450,000 00	3,500 00	2,251,578 75		137,078 31
Hartford Fire	Hartford	801,500 00	857,700 00	7,178,654 35	7,800 00	859,070 12
Home	New York	1,718,265 81	160,400 00	10,338,380 00	249,375 00	514,815 89
Insurance Company of North America	Philadelphia	855,696 70	1,712,184 05	4,932,217 00	94,700 00	916,001 32
Insurance Company of the State of Penn.	Philadelphia	346,019 37	34,300 00			35,597 17
Kings County Fire	New York	70,000 00	10,100 00	257,900 00		9,341 68
Magdeburg Fire	New York			262,675 00		18,958 19
Manhattan Fire	New York			533,337 50		56,875 32
Mercantile Fire and Marine	Boston		184,100 00	335,983 00		24,242 73
Merchants	Newark	187,028 82	318,500 00	658,700 00		52,326 50
Milwaukee Mechanics	Milwaukee	67,500 00	1,119,687 44	1,061,630 25		100,921 85
National Fire	Hartford	331,784 94	708,815 00	3,175,981 00		287,140 08

National Standard	New York			423,650 00		63,160 81
New Hampshire Fire	Manchester	156,417 83	585,374 00	2,171,930 00	52,755 00	248,979 39
Niagara Fire	New York		311,375 00	2,240,200 00		67,502 75
North German Fire	New York			273,612 50		5,540 99
Northwestern National	Milwaukee		1,014,156 67	1,593,380 00		130,987 75
Orient	Hartford	99,060 33	173,675 00	1,807,525 92		55,513 35
Pelican	New York			339,970 20		18,709 29
Pennsylvania Fire	Philadelphia	229,666 67	735,100 00	3,680,075 00	243,200 00	145,684 52
Phenix	Brooklyn	543,000 00	75,600 00	4,058,325 00	66,900 00	623,962 39
Phœnix	Hartford	508,245 82	84,169 61	4,203,037 50	9,000 00	272,245 96
Providence-Washington	Providence, R. I.			1,776,335 00		106,927 26
Queen	New York	720,164 73		3,424,316 72		207,797 18
Springfield Fire and Marine	Springfield, Mass.	125,000 00	616,800 00	3,723,694 00	40,525 00	211,742 39
St. Paul Fire and Marine	St. Paul	636,350 82	296,475 00	1,171,641 62	76,225 05	174,403 74
Teutonia	New Orleans	40,000 00		573,165 00		32,045 31
Traders	Chicago	45,746 17	176,850 00	1,905,759 40	21,000 00	104,886 49
Union	Philadelphia	160,000 00	9,900 00	279,187 75	4,400 00	26,285 61
Victoria Fire	New York			248,010 00		497 81
United States Fire	New York	46,000 00	309,200 00	268,171 25		21,054 70
Westchester Fire	New York	225,000 00	588,962 50	1,782,450 00		122,392 56
Williamsburg City Fire	Brooklyn	629,000 00	243,900 00	1,035,700 00	22,500 00	15,466 42
Totals		$14,353,437 99	$19,486,584 98	$118,561,778 42	$1,455,321 93	$9,616,892 02

TABLE No. 28—Continued.

Name.	Location.	Interest Due and Accrued.	Premiums in Course of Collection.	Bills Receivable, Not Matured, Taken for Marine and Inland Risks.	All Other Assets.	Total Assets.
Ætna	Hartford	$736 00	$472,587 21		$88,133 14	$13,357,293 72
Agricultural	Watertown, N. Y.	43,107 45	135,107 37		1,225 01	2,223,536 35
American	Newark	42,391 08	152,486 08	$97,923 37	1,320 22	3,673,483 46
American	Boston	2,802 82	46,640 11		142 33	624,633 51
American Central	St. Louis		135,137 84	959 72		2,019,566 75
American Fire	Philadelphia	15,574 97	133,139 87		27,580 06	2,477,069 00
American Fire	New York	2,295 83	253,140 38		30,932 01	1,478,229 12
Assurance Company of America	New York	1,278 59	53,256 00		1,557 00	520,988 54
Caledonian American	New York	2,368 75	27,863 71		43 58	372,546 29
Commercial Union Fire	New York	1,722 08	44,637 85			343,418 17
Continental	New York	68,241 06	588,149 88	89,512 70	1,614 00	10,638,271 47
Delaware	Philadelphia	15,207 07	112,231 46			1,507,201 67
Equitable Fire and Marine	Providence, R. I.		86,829 11	363 75	1,285 00	918,503 18
Fire Association	Philadelphia	63,067 40	838,263 53		24,757 07	6,340,250 99
Franklin Fire	Philadelphia	2,424 98	71,594 79			3,083,799 30
German	Freeport, Ill.	72,994 98	302,621 16	61,380 71		3,714,904 52
German Alliance	New York		77,313 17			1,015,236 11
German-American	New York	173 00	586,236 99			8,676,281 34
Germania Fire	New York	10,153 75	227,204 07		15,977 08	4,963,800 48
Girard Fire and Marine	Philadelphia	21,644 26	95,696 06	27,523 13	12,493 30	2,070,496 90
Glens Falls	Glens Falls, N. Y.	13,425 32	118,941 91	922 84		3,436,899 05
Greenwich	New York		288,575 56	13,991 07	4,748 32	1,903,272 46
Hanover Fire	New York	17,130 41	240,077 40		8,940 83	3,108,305 70
Hartford Fire	Hartford	24,915 52	1,238,541 52		11,043 52	10,979,255 03
Home	New York	47,664 54	608,435 57	496 72		13,637,833 53
Insurance Company of North America	Philadelphia	20,993 19	945,021 81	39,593 19	15,856 10	9,532,263 36
Insurance Company of the State of Penn.	Philadelphia	606 13	68,792 48	1,963 25	52,538 88	539,817 28
Kings County Fire	New York	805 01	22,449 72		490 27	371,086 68
Magdeburg Fire	New York	1,441 67	8,567 17			291,642 03
Manhattan Fire	New York	2,067 71	239,499 08	21,213 09	100 00	853,092 70
Mercantile Fire and Marine	Boston		28,789 14			573,114 87
Merchants	Newark	7,607 28	160,039 50		4,503 98	1,388,706 08
Milwaukee Mechanics	Milwaukee	25,805 39	144,368 97			2,519,913 90
National Fire	Hartford		488,971 36			4,992,692 38
National Standard	New York	2,436 61	58,511 08		1,552 00	549,310 50
New Hampshire Fire	Manchester	7,888 45	191,575 46			3,414,920 13
Niagara Fire	New York	10,172 88	270,139 43			2,899,390 06

North German Fire	New York	1,733 32	21,184 19	3,500 00		305.571 00
Northwestern National	Milwaukee	13,074 91	203,539 87			2,955,139 20
Orient	Hartford	30,844 73	203,551 25		8,867 75	2,379.038 33
Pelican	New York		27,321 44		1,314 13	387,315 06
Pennsylvania Fire	Philadelphia	14,008 99	289,093 78		393 47	5,337,222 43
Phenix	Brooklyn	7.728 31	616.076 80		3.112 38	5.994,704 88
Phœnix	Hartford	32.063 50	469.809 49		4,922 37	5,583,494 25
Providence-Washington	Providence, R. I.	7,044 13	207,007 34	24,983 70		2.122,297 43
Queen	New York	43.232 76	351,138 80		4.731 57	4.751,381 76
Springfield Fire and Marine	Springfield, Mass.	47,756 13	391.502 59		2,603 36	5,159,623 47
St. Paul Fire and Marine	St. Paul		234.363 55	16,932 34		2,606,392 12
Teutonia	New Orleans		76,000 32			721,210 63
Traders	Chicago	10.913 15	151,066 65		15.975 24	2.432,197 10
Union	Philadelphia	150 00	56,407 13	1,120 82	7,668 47	545.119 78
Victoria Fire	New York	1,857 33	5,443 73			255,808 87
United States Fire	New York	2.477 57	96.891 65		10 00	743,805 17
Westchester Fire	New York	10.739 50	213.216 48			2.942,761 04
Williamsburg City Fire	Brooklyn	7,783 90	102,601 89		9,347 47	2.066,299 68
Totals		$780.582 41	$13,277,650 75	$492.380 40	$365,779 91	$178.300,408 81

TABLE NO. 29.

Showing the various items composing the Liabilities, except Capital Stock, of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—Companies of other States.

Name.	Location.	Losses Adjusted.	Losses Unadjusted.	Losses Resisted.	Cash Dividends.	Fire Reinsurance.
Ætna	Hartford	$75,830 95	$337,186 95	$19,092 00		$3,329,848 78
Agricultural	Watertown, N. Y.	22,535 94	58,220 00	8,663 00		1,085,576 86
American	Newark	8,132 65	62,078 68	2,000 00	$4,127 35	1,382,057 27
American	Boston	3,232 17	11,904 32			169,307 91
American Central	St. Louis	25,085 05	27,751 33	7,850 00		712,717 63
American Fire	Philadelphia	37,170 40	82,941 09	5,991 55		1,603,605 54
American Fire	New York	53,553 75	44,890 41	1,342 68		604,355 49
Assurance Company of America	New York	1,086 00	19,012 00	250 00		143,711 81
Caledonian American	New York	7,891 62	7,297 22	1,250 00		74,276 88
Commercial Union Fire	New York	6,383 00	10,700 00	5,200 00		80,648 81
Continental	New York		330,851 75	40,815 00		4,272,117 52
Delaware	Philadelphia	1,296 52	60,495 48	1,875 00	77 00	635,805 30
Equitable Fire and Marine	Providence, R. I.	9,608 38	29,083 62	3,043 00		328,842 51
Fire Association	Philadelphia	128,555 82	144,639 90	40,994 71		4,253,438 02
Franklin Fire	Philadelphia	10,745 74	24,703 42	1,675 00	140 00	1,539,900 06
German	Freeport, Ill.	38,427 38	50,027 18	12,850 00		2,028,938 02
German Alliance	New York	25,135 33	19,642 00			202,620 29
German-American	New York	169,939 00	160,081 00	41,863 00		2,742,697 52
Germania Fire	New York	50,478 60	21,912 01	9,181 00		1,563,778 00
Girard Fire and Marine	Philadelphia		20,608 37	2,575 00		1,029,003 08
Glens Falls	Glens Falls, N. Y.	25,120 16	18,720 52	6,723 60		931,093 40
Greenwich	New York	9,666 29	154,272 23	7,775 00		1,073,654 85
Hanover Fire	New York	132,867 86	90,228 62	19,847 20		1,328,336 32
Hartford Fire	Hartford	232,622 44	367,659 82	54,866 14		5,467,046 72
Home	New York	127,725 37	354,242 73	47,350 71		4,299,049 00
Insurance Company of North America	Philadelphia	103,943 48	539,577 52	41,111 00		3,917,069 47
Insurance Company of the State of Penn.	Philadelphia	628 92	19,325 26			241,332 70
Kings County Fire	New York	2,025 25	6,190 00	300 00		62,836 03
Magdeburg Fire	New York		3,618 00			44,567 44
Manhattan Fire	New York	17,123 64	26,545 17	7,000 00		125,472 00
Mercantile Fire and Marine	Boston		7,351 39	8,172 00		122,466 04
Merchants	Newark	27,812 49	57,122 58	10,809 01		651,115 12
Milwaukee Mechanics	Milwaukee	24,137 46	31,238 04	10,950 00		821,032 72
National Fire	Hartford	84,755 86	139,996 22	22,737 79		2,045,419 76
National Standard	New York	2,218 00	15,634 00	1,635 00		144,432 22
New Hampshire Fire	Manchester	66,408 04	97,858 00	16,520 00		1,177,182 78
Niagara Fire	New York	89,614 96	69,576 23	13,637 50		1,354,147 26

North German Fire	New York	486 98	4,164 05	2,735 00		58,819 33
Northwestern National	Milwaukee	6,016 28	43,411 34	1,200 00		1,231,843 90
Orient	Hartford	13,011 77	190,334 36	18,852 11		928,604 80
Pelican	New York	1,496 00	13,716 00			73,786 75
Pennsylvania Fire	Philadelphia	56,509 80	135,809 22	8,600 00		2,570,119 54
Phenix	Brooklyn		226,825 50	11,790 00		3,039,403 97
Phœnix	Hartford	48,756 87	188,066 48	16,238 80		2,087,882 17
Providence-Washington	Providence, R. I.	20,689 84	153,600 42	18,133 86		817,025 52
Queen	New York	82,691 17	65,019 49	35,880 18		1,577,485 57
Springfield Fire and Marine	Springfield, Mass.	63,667 72	108,388 09	20,350 94		1,569,772 79
St. Paul Fire and Marine	St. Paul	43,076 27	104,352 92	14,944 07		1,109,526 93
Teutonia	New Orleans	28,156 81			13,150 00	235,355 16
Traders	Chicago	37,187 13	58,175 90	11,435 00		787,288 05
Union	Philadelphia	12,376 78	17,538 27	4,000 00		239,933 31
Victoria Fire	New York	530 39	4,993 36			44,501 47
United States Fire	New York	8,256 79	32,126 26	5,563 48		244,541 61
Westchester Fire	New York	38,070 89	87,121 35	7,950 00		1,290,360 44
Williamsburg City Fire	Brooklyn	14,954 05	32,972 34	2,846 15	1,996 00	616,091 01
Totals		$2,097,694 06	$4,989,798 41	$656,465 48	$19,490 35	$70,111,843 45

TABLE No. 29—Continued.

Name.	Location.	Marine Reinsurance.	All Other Claims.	Total Liabilities.	Net Surplus.
Ætna	Hartford	$192,698 26	$189,034 88	$4,143,691 82	$5,213,601 90
Agricultural	Watertown, N. Y.			1,174,995 80	548,540 55
American	Newark		15,295 36	1,473,691 31	1,599,792 15
American	Boston		24,987 08	209,431 48	115,202 03
American Central	St. Louis		20,270 67	793,674 68	625,892 07
American Fire	Philadelphia			1,729,708 58	247,360 42
American Fire	New York		61,878 24	766,020 57	312,208 55
Assurance Company of America	New York		27,049 93	191,109 74	129,878 80
Caledonian American	New York		9,261 61	99,977 33	72,568 96
Commercial Union Fire	New York		17,254 59	120,186 40	23,231 77
Continental	New York		483,947 90	5,127,732 17	4,510,539 30
Delaware	Philadelphia			699,549 30	104,777 37
Equitable Fire and Marine	Providence, R. I.	3,634 71	14,210 10	388,422 32	130,080 86
Fire Association	Philadelphia		346,573 37	4,914,201 82	926,049 17
Franklin Fire	Philadelphia		12,348 85	1,589,513 07	1,094,286 23
German	Freeport, Ill.		109,440 24	2,239,682 82	1,275,221 70
German Alliance	New York		27,054 20	274,451 82	340,784 29
German-American	New York		293,989 12	3,408,569 64	4,267,711 70
Germania Fire	New York		42,475 49	1,687,825 10	2,275,975 38
Girard Fire and Marine	Philadelphia		50,199 50	1,102,385 95	668,110 95
Glens Falls	Glens Falls, N. Y.		28,051 28	1,009,708 96	2,227,190 09
Greenwich	New York	100,805 69	194,038 49	1,540,212 55	163,059 91
Hanover Fire	New York		51,362 40	1,622,642 40	485,663 30
Hartford Fire	Hartford		84,300 00	6,206,495 12	3,522,759 91
Home	New York	303,802 50	264,890 88	5,397,061 19	5,240,772 34
Insurance Company of North America	Philadelphia	235,708 40	94,154 48	4,931,564 35	1,600,699 01
Insurance Company of the State of Pennsylvania	Philadelphia		26,104 90	287,391 78	52,425 50
Kings County Fire	New York		6,019 71	77,370 99	93,715 69
Magdeburg Fire	New York		2,152 57	50,338 01	41,304 02
Manhattan Fire	New York		138,938 34	315,079 15	38,013 55
Mercantile Fire and Marine	Boston		10,778 22	148,767 65	24,347 22
Merchants	Newark		58,711 53	805,570 73	183,135 35
Milwaukee Mechanics	Milwaukee		77,203 40	964,561 62	1,355,352 28
National Fire	Hartford		165,903 04	2,458,812 67	1,533,879 71
National Standard	New York		29,697 43	193,616 65	155,693 85
New Hampshire Fire	Manchester		53,696 28	1,411,665 10	1,003,255 03
Niagara Fire	New York		60,578 90	1,587,554 85	811,835 21
North German Fire	New York		7,873 63	74,078 99	31,492 01
Northwestern National	Milwaukee	16,666 52	63,703 68	1,362,841 72	992,297 48

Orient	Hartford		64,193 93	1,214,996 97	664,041 36
Pelican	New York		15,055 31	104,054 06	83,261 00
Pennsylvania Fire	Philadelphia		4,000 00	2,775,038 56	2,162,183 87
Phenix	Brooklyn		182,905 77	3,460,925 24	1,533,779 64
Phœnix	Hartford			2,340,944 32	1,242,549 93
Providence-Washington	Providence, R. I.	112,415 32		1,121,864 96	500,432 47
Queen	New York		141,101 49	1,902,177 90	2,349,203 86
Springfield Fire and Marine	Springfield, Mass.		78,300 52	1,840,480 06	1,819,143 41
St. Paul Fire and Marine	St. Paul	146,683 39	35,154 53	1,453,738 11	652,654 01
Teutonia	New Orleans		4,000 00	280,661 97	190,548 66
Traders	Chicago		26,212 96	920,299 04	1,011,898 06
Union	Philadelphia		15,734 58	289,582 94	55,536 84
Victoria Fire	New York		816 56	50,841 78	4,967 09
United States Fire	New York	31,840 56	47,376 58	369,705 28	124,099 89
Westchester Fire	New York			1,423,502 68	1,219,258 36
Williamsburg City Fire	Brooklyn		26,545 51	695,405 06	1,120,894 62
Totals		$1,144,255 35	$3,804,828 03	$82,824,375 13	$58,773,158 68

TABLE No. 30.

Showing the various items composing the Incomes of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—Companies of other States.

Name.	Location.	Fire Premiums.	Marine Premiums.	Interest on Mortgage Loans.	Interest and Dividends From Other Sources.	Rents.	From All Other Sources.	Total Income.
Ætna	Hartford	$3,883,804 54	$310,539 49	$936 00	$509,735 59	$5,472 72	$51,720 32	$4,762,208 66
Agricultural	Watertown, N. Y.	936,960 16	----	45,293 04	37,628 69	4,365 81	840 68	1,025,088 38
American	Newark	1,018,336 03	----	89,078 05	58,411 85	4,711 51	----	1,170,537 44
American	Boston	211,996 15	----	----	21,615 13	----	820 26	234,431 54
American Central	St. Louis	867,876 34	----	----	58,527 42	----	16,982 59	943,386 35
American Fire	Philadelphia	1,330,001 80	----	50,377 55	40,660 21	8,854 00	3,815 42	1,433,708 98
American Fire	New York	941,687 63	----	759 17	41,956 72	----	----	984,403 52
Assurance Company of America	New York	225,288 40	----	----	13,904 82	----	3,960 66	243,153 88
Caledonian American	New York	105,835 17	----	----	11,125 00	----	----	116,960 17
Commercial Union Fire	New York	115,286 61	----	----	8,122 29	----	----	123,408 90
Continental	New York	4,294,530 98	----	3,769 14	347,118 95	22,201 29	----	4,667,620 36
Delaware	Philadelphia	699,612 79	----	4,529 16	46,622 17	9,820 00	1,112 56	761,696 68
Equitable Fire and Marine	Providence, R. I.	462,607 33	6,785 64	7,683 61	21,134 25	1,103 44	----	499,314 27
Fire Association	Philadelphia	2,912,667 71	----	107,244 70	137,662 65	18,697 93	5,704 60	3,181,977 59
Franklin Fire	Philadelphia	505,492 03	----	9,168 35	111,895 01	6,625 07	1,315 50	634,495 96
German	Freeport, Ill.	1,781,481 96	----	91,100 48	47,737 97	2,469 64	1,619 57	1,924,409 62
German Alliance	New York	276,123 97	----	----	36,800 58	----	----	312,924 55
German-American	New York	2,995,188 08	----	2,234 45	310,613 16	----	----	3,308,035 69
Germania Fire	New York	1,195,580 52	----	17,389 48	142,607 24	----	----	1,355,577 24
Girard Fire and Marine	Philadelphia	391,730 90	----	39,918 40	34,973 30	13,648 87	8,828 43	489,099 90
Glens Falls	Glens Falls, N. Y.	838,092 98	----	71,087 44	107,099 04	2,011 41	----	1,018,290 87
Greenwich	New York	1,286,808 37	178,194 02	----	45,429 71	16,125 00	----	1,526,557 10
Hanover Fire	New York	1,720,597 26	----	175 00	89,158 85	27,802 54	25,189 40	1,862,923 05
Hartford Fire	Hartford	6,684,746 58	----	61,660 04	312,845 76	13,181 70	500 57	7,072,934 65
Home	New York	4,637,803 80	258,839 33	10,695 44	382,783 32	166,773 25	----	5,456,895 14
Insurance Company of North America	Philadelphia	4,099,633 54	1,811,966 53	105,580 38	223,285 49	29,584 69	188,216 60	6,458,267 23
Insurance Company of the State of Pennsylvania	Philadelphia	114,057 47	----	2,353 20	8,691 67	18,967 20	110,524 16	254,593 70
Kings County Fire	New York	102,156 13	----	511 00	9,859 96	4,030 92	19,561 07	136,119 08
Magdeburg Fire	New York	66,867 92	----	----	8,702 22	----	268 75	75,838 89
Manhattan Fire	New York	524,405 45	57,934 26	----	13,111 40	----	43,044 92	638,496 03
Mercantile Fire and Marine	Boston	158,786 05	910 70	7,226 12	15,176 92	----	----	182,099 79

Merchants	Newark	823,841 42		18,350 47	29,747 50	7,117 79	19,088 36	898,145 54
Milwaukee Mechanics	Milwaukee	900,262 89		78,869 43	41,259 97	3,914 00	3,787 10	1,028,093 39
National Fire	Hartford	2,735,587 12		41,961 04	149,122 88	3,026 01	2,781 75	2,932,478 80
National Standard	New York	238,879 59			13,292 18		25,750 00	277,921 77
New Hampshire Fire	Manchester	1,304,125 78		33,727 35	102,233 73	16,870 75	13,023 26	1,469,980 87
Niagara Fire	New York	1,653,821 65		21,048 88	80,562 36		3,864 00	1,759,296 89
North German Fire	New York	105,390 04			8,785 61			114,175 65
Northwestern National	Milwaukee	1,013,867 55	17,868 66	48,073 53	64,443 76		11,693 75	1,155,947 25
Orient	Hartford	1,265,773 17	811 62	11,914 69	61,589 80	2,343 67		1,342,432 95
Pelican	New York	133,652 70			9,221 57			142,874 27
Pennsylvania Fire	Philadelphia	1,918,994 54		29,204 62	174,357 22	9,668 43	1,061 28	2,133,286 09
Phenix	Brooklyn	3,282,107 36		3,950 98	130,879 42	19,530 43		3,436,468 19
Phœnix	Hartford	2,769,146 97		6,347 43	203,741 60	11,809 46		2,991,045 46
Providence-Washington	Providence, R. I.	1,056,986 95	401,733 48		60,376 81		34,781 25	1,553,878 49
Queen	New York	1,952,080 14			133,597 07	18,417 54	619 53	2,104,714 28
Springfield Fire and Marine	Springfield, Mass.	1,942,320 35		32,284 81	150,162 70	4,653 35		2,129,421 21
St. Paul Fire and Marine	St. Paul	1,497,723 85	342,561 41	16,886 26	59,494 57	18,074 43		1,934,740 52
Teutonia	New Orleans	444,722 15	26,561 52		26,117 76			497,401 43
Traders	Chicago	1,088,617 06		14,323 06	80,663 48	1,212 87		1,184,816 47
Union	Philadelphia	278,601 51		495 00	16,565 50	2,724 91	73	298,387 65
Victoria Fire	New York	89,820 23			8,025 04			97,845 27
United States Fire	New York	318,111 65	33,469 23	8,123 39	17,180 30	642 06	138 29	377,664 92
Westchester Fire	New York	1,526,003 33		34,459 21	78,404 74	1,563 25	10,227 50	1,650,658 03
Williamsburg City Fire	Brooklyn	665,497 13		13,995 73	43,426 16	3,293 69		726,212 71
Totals		$74,391,979 78	$3,448,175 89	$1,142,786 08	$4,998,249 07	$501,309 63	$610,842 86	$85,093,343 31

TABLE NO. 31.

Showing the various items composing the Expenditures of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—Companies of other States.

Name.	Location.	Fire Losses.	Marine Losses.	Dividends.	Brokerage and Commission.
Ætna	Hartford	$2,437,765 07	$164,283 36	$720,000 00	$705,217 59
Agricultural	Watertown, N. Y.	567,443 45		50,240 00	179,246 12
American	Newark	596,750 81		60,966 25	239,300 34
American	Boston	131,184 25		9,000 00	47,028 51
American Central	St. Louis	503,403 18		60,000 00	157,753 68
American Fire	Philadelphia	987,738 24		35,000 00	294,989 85
American Fire	New York	694,234 11			195,664 30
Assurance Company of America	New York	183,812 79	452 93	24,000 00	71,686 34
Caledonian American	New York	82,803 75			24,976 90
Commercial Union Fire	New York	87,145 01		10,000 00	23,753 87
Continental	New York	2,220,299 31		250,000 00	888,650 39
Delaware	Philadelphia	474,554 52		42,192 50	146,882 44
Equitable Fire and Marine	Providence, R. I.	279,686 35	4,205 88	28,000 00	94,359 99
Fire Association	Philadelphia	1,843,580 11		200,000 00	658,671 79
Franklin Fire	Philadelphia	318,171 63		80,005 00	110,613 32
German	Freeport, Ill.	895,817 81		60,000 00	458,946 70
German Alliance	New York	200,054 30			61,276 95
German-American	New York	1,712,456 83		300,000 00	482,068 07
Germania Fire	New York	651,153 22		150,000 00	236,401 49
Girard Fire and Marine	Philadelphia	252,680 75		63,000 00	97,181 08
Glens Falls	Glens Falls, N. Y.	452,074 03		60,000 00	189,674 41
Greenwich	New York	739,249 75	89,951 23	20,000 00	287,248 20
Hanover Fire	New York	1,111,812 74		100,000 00	345,859 22
Hartford Fire	Hartford	4,371,957 66		400,000 00	1,163,657 81
Home	New York	2,538,136 83	174,967 30	300,000 00	869,200 63
Insurance Company of North America	Philadelphia	2,754,102 35	1,137,593 52	360,000 00	1,109,958 56
Insurance Co. of the State of Pennsylvania	Philadelphia	198,339 33			82,776 03
Kings County Fire	New York	61,613 19		10,000 00	25,912 02
Magdeburg Fire	New York	47,640 91			14,471 76
Manhattan Fire	New York	524,981 20	12,431 39	40,500 00	133,760 31
Mercantile Fire and Marine	Boston	114,254 56			33,824 50
Merchants	Newark	674,708 09		32,000 00	152,445 54
Milwaukee Mechanics	Milwaukee	530,932 54		80,000 00	219,223 54
National Fire	Hartford	1,524,884 93		120,000 00	467,903 20
National Standard	New York	180,903 27	264 34	24,000 00	72,935 65

New Hampshire Fire	Manchester	828,894 06		100,000 00	305,609 63
Niagara Fire	New York	1,025,084 15		50,000 00	314,451 55
North German Fire	New York	43,382 61			30,336 90
Northwestern National	Milwaukee	454,049 63	2,543 26	72,000 00	226,786 84
Orient	Hartford	918,156 11	20,588 55	25,000 00	246,574 94
Pelican	New York	65,633 50			34,283 42
Pennsylvania Fire	Philadelphia	1,251,010 16		100,000 00	445,125 67
Phenix	Brooklyn	1,935,886 42		100,000 00	628,691 20
Phœnix	Hartford	1,729,459 61		280,000 00	516,420 00
Providence-Washington	Providence, R. I.	732,298 24	276,799 47	50,000 00	283,295 20
Queen	New York	1,263,648 79		100,000 00	321,249 78
Springfield Fire and Marine	Springfield, Mass.	1,142,707 20		150,000 00	354,910 29
St. Paul Fire and Marine	St. Paul	884,424 95	178,601 43	50,000 00	389,761 52
Teutonia	New Orleans	280,654 79	11,545 77	25,000 00	106,318 15
Traders	Chicago	658,336 32		50,000 00	239,243 85
Union	Philadelphia	196,658 49		12,000 00	56,281 38
Victoria Fire	New York	79,460 11			17,563 79
United States Fire	New York	167,823 88	16,736 32	20,000 00	93,682 27
Westchester Fire	New York	887,452 44		48,000 00	333,399 89
Williamsburg City Fire	Brooklyn	369,888 86		59,286 00	170,531 17
Totals		$45,861,237 19	$2,090,964 75	$4,980,189 75	$15,458,038 54

TABLE No. 31—Continued.

Name.	Location.	Office Salaries.	Taxes.	All Other Expenditures.	Total Expenditures.
Ætna	Hartford	$298,358 39	$128,011 80	$345,102 96	$4,798,739 17
Agricultural	Watertown, N. Y.	92,930 57	48,267 44	108,514 82	1,046,642 40
American	Newark	79,675 62	47,301 02	74,617 87	1,098,611 91
American	Boston	20,681 14	8,918 75	34,643 85	251,456 50
American Central	St. Louis	73,986 12	27,172 29	119,664 02	941,979 29
American Fire	Philadelphia	48,100 00	47,885 63	192,502 35	1,606,216 07
American Fire	New York	63,204 31	29,086 46	54,530 16	1,036,719 34
Assurance Company of America	New York	3,085 00	6,319 25	2,845 92	292,202 23
Caledonian American	New York	2,626 71	3,581 60	3,077 14	117,066 10
Commercial Union Fire	New York	3,786 58	5,170 04	3,074 59	132,930 09
Continental	New York	317,278 20	131,856 71	236,837 97	4,044,922 58
Delaware	Philadelphia	72,702 30	29,505 84	76,507 04	842,344 64
Equitable Fire and Marine	Providence, R. I.	36,964 30	16,256 23	29,459 54	488,932 29
Fire Association	Philadelphia	237,729 22	112,147 59	137,092 21	3,189,220 92
Franklin Fire	Philadelphia	36,361 67	25,685 89	78,601 13	649,438 64
German	Freeport, Ill.	93,674 82	43,561 32	165,611 98	1,717,612 63
German Alliance	New York	1,800 00	19,920 89	42 15	283,094 29
German-American	New York	209,502 70	98,730 82	326,777 77	3,129,536 19
Germania Fire	New York	137,606 05	49,700 32	78,978 02	1,303,839 10
Girard Fire and Marine	Philadelphia	58,195 17	25,001 59	57,819 79	553,878 38
Glens Falls	Glens Falls, N. Y.	64,138 17	59,171 40	66,008 66	891,066 67
Greenwich	New York	133,764 17	23,910 48	228,788 00	1,522,911 83
Hanover Fire	New York	147,839 23	68,207 33	158,215 76	1,931,934 28
Hartford Fire	Hartford	511,705 04	197,520 96	641,808 64	7,286,650 11
Home	New York	419,159 23	164,126 76	486,131 82	4,951,722 57
Insurance Company of North America	Philadelphia	336,142 40	120,221 72	296,508 80	6,114,527 35
Insurance Co. of the State of Pennsylvania	Philadelphia	16,338 33	10,755 51	65,958 59	374,167 79
Kings County Fire	New York	8,563 42	5,310 75	12,845 90	124,245 28
Magdeburg Fire	New York	3,500 02	2,545 34	4,823 08	72,981 11
Manhattan Fire	New York	44,677 46	16,683 93	57,412 13	830,446 42
Mercantile Fire and Marine	Boston	22,186 02	4,127 50	29,985 86	204,378 44
Merchants	Newark	150,966 64	43,134 89	45,634 48	1,098,889 64
Milwaukee Mechanics	Milwaukee	65,818 46	40,648 59	78,259 17	1,014,882 30
National Fire	Hartford	183,241 96	94,541 63	355,248 17	2,745,819 89
National Standard	New York	2,765 00	7,820 06	2,334 39	291,022 71
New Hampshire Fire	Manchester	65,143 78	60,698 65	110,948 35	1,471,294 47
Niagara Fire	New York	156,581 60	47,668 11	146,288 76	1,740,074 17
North German Fire	New York	3,942 20	4,814 67	4,279 50	86,755 88
Northwestern National	Milwaukee	115,694 92	37,752 75	67,255 90	976,083 30

Orient	Hartford	87,051 78	40,559 91	113,780 47	1,451,711 76
Pelican	New York	4,140 00	4,663 39	7,796 26	116,516 57
Pennsylvania Fire	Philadelphia	93,598 00	61,910 35	101,844 94	2,053,489 12
Phenix	Brooklyn	319,535 39	107,470 05	341,900 36	3,433,483 42
Phœnix	Hartford	186,692 34	88,315 12	286,702 85	3,087,589 92
Providence-Washington	Providence, R. I.	82,963 47	46,677 43	63,617 83	1,535,651 64
Queen	New York	176,347 46	63,064 22	121,171 11	2,045,481 36
Springfield Fire and Marine	Springfield, Mass.	110,745 57	92,282 18	213,817 51	2,064,462 75
St. Paul Fire and Marine	St. Paul	86,205 73	49,413 87	146,151 09	1,784,558 59
Teutonia	New Orleans	27,304 30	8,567 42	38,390 35	497,780 78
Traders	Chicago	73,928 89	34,251 50	72,268 61	1,128,029 17
Union	Philadelphia	43,332 42	8,067 09	27,788 63	344,128 01
Victoria Fire	New York	4,709 41	3,074 21	3,851 12	108,658 64
United States Fire	New York	25,071 67	10,662 52	37,053 94	371,030 60
Westchester Fire	New York	111,034 70	43,501 84	141,175 66	1,564,564 53
Williamsburg City Fire	Brooklyn	74,709 40	8,651 17	50,499 85	733,566 45
Totals		$5,847,787 45	$2,584,874 78	$6,752,847 82	$83,575,940 28

TABLE No. 32.

Showing amount of Risks Written, Premiums Received, and amount of Risks in Force on December 31, 1900, with Premiums thereon, of Fire and Fire and Marine Insurance Companies doing business in California—Companies of other States.

Name.	Location.	Risks Written During the Year.				
		Fire.	Premiums.	Marine.	Premiums.	Total Premiums.
Ætna	Hartford	$449,746,863 00	$5,082,040 78	$137,715,918 00	$422,153 41	$5,504,194 19
Agricultural	Watertown, N. Y.	159,364,200 00	1,500,351 72			1,500,351 72
American	Newark	144,690,543 00	1,464,791 29			1,464,791 29
American	Boston	28,844,803 00	304,187 12			304,187 12
American Central	St. Louis	97,121,715 00	1,102,885 61			1,102,885 61
American Fire	Philadelphia	198,369,667 00	1,697,384 16			1,697,384 16
American Fire	New York	180,163,849 00	1,380,488 77			1,380,488 77
Assurance Company of America	New York	37,848,294 00	394,532 69			394,532 69
Caledonian American	New York	17,499,515 00	158,538 04			158,538 04
Commercial Union Fire	New York	27,350,365 00	263 390 80			263,390 80
Continental	New York	600,640,582 00	4,960,236 11			4,960,236 11
Delaware	Philadelphia	94,592,824 00	1,084,959 73			1,084,959 73
Equitable Fire and Marine	Providence, R. I.	49,689,746 00	562,757 07	608,007 00	8,957 08	571,714 15
Fire Association	Philadelphia	304,327,744 00	3,753,912 24			3,753,912 24
Franklin Fire	Philadelphia	55,094,531 00	626,277 70			626,277 70
German	Freeport, Ill.	177,681,378 00	2,239,681 47			2,239,681 47
German Alliance	New York	41,897,984 00	348,478 69			348,478 69
German-American	New York	529,306,767 00	4,731,936 23			4,731,936 23
Germania Fire	New York	216,550,840 00	1,690,660 88			1,690,660 88
Girard Fire and Marine	Philadelphia	51,773,827 00	524,666 28			524,666 28
Glens Falls	Glens Falls, N. Y.	97,089,269 00	1,034,936 68			1,034,936 68
Greenwich	New York	211,775,301 00	1,785,380 36	53,118,216 00	206,636 98	1,992,017 34
Hanover Fire	New York	228,988,190 00	2,340,886 63			2,340,886 63
Hartford Fire	Hartford	705,252,502 00	8,442,122 51			8,442,122 51
Home	New York	559,358,869 00	5,280,838 81	398,754,420 00	2,230,060 44	7,510,899 25
Insurance Company of North America	Philadelphia	801,749,520 00	7,087,455 61	82,976,503 00	527,964 03	7,615,419 64
Insurance Co. of the State of Pennsylvania	Philadelphia	35,381,189 00	415,652 14			415,652 14
Kings County Fire	New York	17,253,880 00	149,168 33			149,168 33
Magdeburg Fire	New York	10,834,896 00	106,180 53			106,180 53
Manhattan Fire	New York	81,316,760 00	1,054,600 57	4,830,584 00	78,051 68	1,132,652 25
Mercantile Fire and Marine	Boston	26,740,609 00	273,904 51			273,904 51
Merchants	Newark	118,615,366 00	1,258,244 95			1,258,244 95

Milwaukee Mechanics	Milwaukee	96,037,125 00	1,193,551 28			1,193,551 28
National Fire	Hartford	380,426,541 00	3,691,385 98			3,691,385 98
National Standard	New York	38,655,272 00	404,987 61			404,987 61
New Hampshire Fire	Manchester	151,157,717 00	1,741,658 38			1,741,658 38
Niagara Fire	New York	226,161,265 00	2,318,518 90			2,318,518 90
North German Fire	New York	12,961,552 00	143,185 42			143,185 42
Northwestern National	Milwaukee	136,092,243 00	1,272,260 63	217,178 00	18,023 98	1,290,284 61
Orient	Hartford	188,790,718 00	1,882,964 19	266,264 00	8,392 37	1,891,356 56
Pelican	New York	20,889,907 00	190,036 57			190,036 57
Pennsylvania Fire	Philadelphia	232,425,355 00	2,531,808 12			2,531,808 12
Phenix	Brooklyn	373,415,424 00	4,117,627 33			4,117,627 33
Phœnix	Hartford	335,540,990 00	3,228,428 77			3,228,428 77
Providence-Washington	Providence, R. I.	166,631,439 00	1,537,714 44	145,082,153 00	598,809 21	2,136,523 65
Queen	New York	247,826,193 00	2,712,924 61			2,712,924 61
Springfield Fire and Marine	Springfield, Mass.	236,949,609 00	2,543,613 63			2,543,613 63
St. Paul Fire and Marine	St. Paul	122,689,749 00	1,832,393 30	70,099,272 00	544,516 02	2,376,909 32
Teutonia	New Orleans	40,501,250 00	657,153 42	5,682,524 00	24,311 07	681,464 49
Traders	Chicago	116,075,063 00	1,445,094 26			1,445,094 26
Union	Philadelphia	33,574,655 00	354,905 90			354,905 90
Victoria Fire	New York	11,551,738 00	113,410 31			113,410 31
United States Fire	New York	43,864,763 00	465,457 79	2,204,145 00	40,722 98	506,180 77
Westchester Fire	New York	197,897,634 00	1,972,144 56			1,972,144 56
Williamsburg City Fire	Brooklyn	86,782,294 00	816,428 77			816,428 77
Totals		$9,853,810,884 00	$100,269,183 18	$901,555,184 00	$4,708,599 25	$104,977,782 43

TABLE No. 32—Continued.

Name.	Location.	Risks in Force December 31, 1900.				
		Fire.	Premiums.	Marine.	Premiums.	Total Premiums.
Ætna	Hartford	$553,773,204 00	$6,331,371 87	$6,362,097 00	$192,698 26	$6,524,070 13
Agricultural	Watertown, N. Y.	232,529,200 00	2,157,191 00			2,157,191 00
American	Newark	260,598,957 00	2,646,565 84			2,646,565 84
American	Boston	30,386,855 00	322,132 67			322,132 67
American Central	St. Louis	130,895,559 00	1,421,991 59			1,421,991 59
American Fire	Philadelphia	187,413,199 00	2,050,856 10			2,050,856 10
American Fire	New York	149,664,207 00	1,148,702 24			1,148,702 24
Assurance Company of America	New York	25,624,823 00	280,393 47			280,393 47
Caledonian American	New York	15,451,937 00	137,728 90			137,728 90
Commercial Union Fire	New York	15,603,719 00	160,452 61			160,452 61
Continental	New York	881,108,971 00	8,237,318 29			8,237,318 29
Delaware	Philadelphia	106,836,046 00	1,024,559 21			1,024,559 21
Equitable Fire and Marine	Providence, R. I.	56,674,963 00	629,910 10	106,693 00	5,864 78	635,774 88
Fire Association	Philadelphia	410,681,756 00	4,793,767 96			4,793,767 96
Franklin Fire	Philadelphia	87,798,788 00	936,785 39			936,785 39
German	Freeport, Ill.	295,307,374 00	3,871,504 39			3,871,504 39
German Alliance	New York	51,893,721 00	394,796 09			394,796 09
German-American	New York	651,386,914 00	5,472,457 06			5,472,457 06
Germania Fire	New York	386,839,242 00	3,065,872 06			3,065,872 06
Girard Fire and Marine	Philadelphia	83,518,765 00	787,188 94			787,188 94
Glens Falls	Glens Falls, N. Y.	176,380,762 00	1,819,044 41			1,819,044 41
Greenwich	New York	280,824,930 00	2,003,674 23	2,671,012 00	100,805 69	2,104,479 92
Hanover Fire	New York	251,501,175 00	2,579,960 38			2,579,960 38
Hartford Fire	Hartford	962,575,069 00	10,940,322 21			10,940,322 21
Home	New York	635,136,397 00	6,243,730 72	5,245,841 00	235,708 40	6,479,439 12
Insurance Company of North America	Philadelphia	884,451,153 00	8,519,704 00	13,168,575 00	367,252 00	8,886,956 00
Insurance Co. of the State of Pennsylvania	Philadelphia	1,771,836 00	22,875 31			22,875 31
Kings County Fire	New York	13,973,936 00	114,331 63			114,331 63
Magdeburg Fire	New York	9,383,314 00	88,996 12			88,996 12
Manhattan Fire	New York	16,247,570 00	250,944 00			250,944 00
Mercantile Fire and Marine	Boston	25,883,904 00	279,974 93			279,974 93
Merchants	Newark	133,751,635 00	1,309,565 32			1,309,565 32
Milwaukee Mechanics	Milwaukee	135,892,740 00	1,590,829 41			1,590,829 41
National Fire	Hartford	401,467,507 00	4,013,046 22			4,013,046 22
National Standard	New York	25,466,843 00	280,613 09			280,613 09

New Hampshire Fire	Manchester	197,697,818 00	2,306,886 61			2,306,886 61
Niagara Fire	New York	279,237,285 00	2,631,798 24			2,631,798 24
North German Fire	New York	9,222,781 00	103,114 16			103,114 16
Northwestern National	Milwaukee	249,307,487 00	2,434,001 33			2,434,001 33
Orient	Hartford	168,265,407 00	1,834,865 95			1,834,865 95
Pelican	New York	14,928,892 00	136,016 71			136,016 71
Pennsylvania Fire	Philadelphia	343,292,886 00	3,313,684 64			3,313,684 64
Phenix	Brooklyn	539,933,290 00	6,024,719 98			6,024,719 98
Phœnix	Hartford	394,984,037 00	4,089,122 64			4,089,122 64
Providence-Washington	Providence, R. I.	162,075,541 00	1,614,428 66	6,629,454 00	215,095 82	1,829,524 48
Queen	New York	303,474,315 00	3,135,789 87			3,135,789 87
Springfield Fire and Marine	Springfield, Mass.	307,528,667 00	3,111,241 63			3,111,241 63
St. Paul Fire and Marine	St. Paul	165,182,342 00	2,129,976 51	3,861,687 00	146,683 39	2,276,659 90
Teutonia	New Orleans	33,187,393 00	441,970 82			441,970 82
Traders	Chicago	116,071,607 00	1,487,364 99			1,487,364 99
Union	Philadelphia	39,714,874 00	407,584 48			407,584 48
Victoria Fire	New York	8,502,195 00	87,418 74			87,418 74
United States Fire	New York	47,617,187 00	473,199 35	1,078,008 00	31,840 56	505,040 91
Westchester Fire	New York	279,236,832 00	2,498,940 23			2,498,940 23
Williamsburg City Fire	Brooklyn	141,183,417 00	1,219,270 47			1,219,270 47
Totals		$12,369,341,224 00	$125,410,553 77	$39,123,367 00	$1,295,948 90	$126,706,502 67

TABLE No. 33—*Summary of Assets, Liabilities, Incomes, Expenditures, etc., and Net Surplus of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—Companies of Foreign Countries.*

Name.	Location.	Cash Capital Paid Up.	Total Assets.	Liabilities, Capital Not Included.	Total Income.
Aachen and Munich Fire	Aix-la-Chapelle		$913,533 71	$437,815 55	$576,579 12
Alliance	London		871,662 81	147,085 01	240,163 50
Atlas*	London	$720,000 00	12,046,535 60	10,063,261 62	2,299,304 29
Baloise	Basle		836,288 72	290,829 83	404,378 83
British America	Toronto		1,310,063 19	881,011 65	1,240,329 99
Caledonian	Edinburgh		1,910,617 66	1,101,382 62	1,298,279 54
Commercial Union	London		3,881,770 52	2,503,269 97	2,736,622 83
Hamburg-Bremen	Hamburg		1,586,975 83	1,087,394 94	1,367,930 41
Helvetia Swiss Fire	St. Gall		867,637 37	338,510 12	460,376 62
Imperial	London		1,894,357 60	1,087,385 43	1,543,833 11
Lancashire	Manchester		2,308,737 53	1,709,855 41	1,955,303 71
Law, Union, and Crown	London		700,784 66	292,837 78	402,829 82
Lion Fire	London		885,040 70	511,382 34	590,613 56
Liverpool and London and Globe	Liverpool		9,804,902 52	5,100,174 15	5,332,033 79
London	London		2,447,677 06	1,038,667 33	1,278,498 04
London and Lancashire Fire	Liverpool		2,641,046 09	1,700,136 30	1,685,879 30
Magdeburg Fire*	Magdeburg	750,000 00	4,750,116 31	2,775,152 17	4,574,959 94
Manchester Fire	Manchester		1,841,098 85	1,289,405 40	1,439,746 78
Netherlands Fire	The Hague		572,967 41	296,705 41	469,219 85
New Zealand	Auckland		496,347 20	105,184 92	128,810 81
North British and Mercantile*	London	3,437,500 00	18,819,441 70	4,885,921 27	8,327,066 25
Northern*	London	1,500,000 00	29,359,871 79	22,085,346 71	6,462,315 13
North German Fire	Hamburg		616,628 85	371,224 64	526,685 23
Norwich Union Fire*	Norwich	660,000 00	6,693,991 98	3,244,453 96	5,055,785 68
Phœnix	London		2,932,934 98	2,136,185 00	2,354,532 34
Prussian National	Stettin		771,703 49	432,372 17	462,481 31
Royal	Liverpool		7,187,715 01	4,698,738 80	4,228,906 71
Royal Exchange*	London	3,446,099 45	24,662,043 35	15,731,611 94	5,256,520 10
Scottish Union and National	Edinburgh		4,312,983 80	2,088,928 91	2,080,072 88
State Fire	Liverpool		329,705 27	88,793 42	144,360 36
Svea Fire and Life*	Gothenburg	533,333 33	7,962,620 15	6,534,468 42	3,028,093 53
Sun	London		2,595,074 73	1,614,553 82	1,571,866 80
Thuringia*	Erfurt	450,000 00	12,216,316 90	10,857,929 14	3,274,845 43
Transatlantic Fire	Hamburg		655,344 54	345,273 72	498,678 47
Union	London		1,643,662 56	919,352 28	1,183,877 20
Western	Toronto		2,016,370 79	1,377,940 21	2,028,005 19
Totals		$11,496,932 78	$175,344,571 23	$110,170,542 36	$76,509,786 46

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* Home office statement.

TABLE No. 33—Continued.

Name.	Location.	Total Expenditures.	Losses Incurred During the Year.	Net Surplus.
Aachen and Munich Fire	Aix-la-Chapelle	$606,370 43	$356,929 09	$475,718 16
Alliance	London	183,818 23	101,781 16	724,577 80
Atlas*	London	2,193,603 25	1,296,726 00	1,263,273 98
Baloise	Basle	407,409 12	254,353 25	545,458 89
British America	Toronto	1,245,564 20	882,721 80	429,051 54
Caledonian	Edinburgh	1,322,569 31	796,862 52	809,235 04
Commercial Union	London	2,683,953 92	1,782,599 00	1,378,500 55
Hamburg-Bremen	Hamburg	1,291,347 80	733,338 62	499,580 89
Helvetia Swiss Fire	St. Gall	527,965 95	326,740 60	529,127 25
Imperial	London	1,552,156 62	868,423 04	806,972 17
Lancashire	Manchester	2,068,249 61	1,306,480 00	598,882 12
Law, Union, and Crown	London	387,168 91	274,010 88	407,946 88
Lion Fire	London	570,962 02	369,108 69	373,658 36
Liverpool and London and Globe	Liverpool	5,039,744 66	3,286,696 56	4,704,728 37
London	London	1,106,838 90	721,343 43	1,409,009 73
London and Lancashire Fire	Liverpool	1,553,438 61	897,821 88	940,909 79
Magdeburg Fire*	Magdeburg	4,498,708 52	3,047,007 43	1,224,964 14
Manchester Fire	Manchester	1,395,255 43	908,754 69	551,693 45
Netherlands Fire	The Hague	562,683 03	350,729 01	276,262 00
New Zealand	Auckland	130,611 68	58,156 86	391,162 28
North British and Mercantile*	London	8,539,546 23	4,861,060 45	10,496,020 43
Northern*	London	5,704,025 08	2,085,943 25	5,774,525 08
North German Fire	Hamburg	592,971 10	387,412 46	245,404 21
Norwich Union Fire*	Norwich	5,096,515 29	3,109,604 51	2,789,538 02
Phœnix	London	2,359,841 46	1,584,399 62	796,749 98
Prussian National	Stettin	484,053 56	280,242 25	339,331 32
Royal	Liverpool	4,262,105 52	2,820,418 87	2,488,976 21
Royal Exchange*	London	4,789,483 40	1,798,607 00	5,484,331 96
Scottish Union and National	Edinburgh	2,075,619 81	1,343,071 72	2,224,054 89
State Fire	Liverpool	138,424 04	84,214 53	240,911 85
Svea Fire and Life*	Gothenburg	2,993,013 08	905,807 18	894,818 40
Sun	London	1,655,344 82	1,054,400 30	980,520 91
Thuringia*	Erfurt	2,747,972 52	680,572 80	908,387 76
Transatlantic Fire	Hamburg	623,418 30	431,470 92	310,070 82
Union	London	1,216,490 07	799,788 11	724,310 28
Western	Toronto	2,063,223 72	1,459,886 56	638,430 58
Totals		$74,670,468 20	$42,307,485 04	$53,677,096 09

* Home office statement.

TABLE No. 34.—*Showing the various items composing the Assets of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—Companies of Foreign Countries.*

Name.	Location.	Real Estate.	Loans on Mortgages.	Stocks and Bonds Owned.	Collateral Loans.	Cash in Office and in Banks.
Aachen and Munich Fire	Aix-la-Chapelle, Ger.	--------	--------	$741,527 50	--------	$75,385 74
Alliance	London	$173,170 87	--------	612,750 00	--------	42,876 23
Atlas*	London	444,986 52	$12,109 39	2,202,741 67	$33,624 02	258,333 81
Baloise Fire	Basle	--------	--------	650,625 00	--------	118,337 84
British America	Toronto	--------	10,000 00	967,448 76	--------	86,671 40
Caledonian	Edinburgh	--------	--------	1,604,660 00	--------	124,835 07
Commercial Union	London	888,148 69	230,500 00	1,882,393 75	--------	203,922 10
Hamburg-Bremen	Hamburg	--------	--------	1,299,356 25	65,000 00	93,724 64
Helvetia Swiss Fire	St. Gall, Switzerland	--------	--------	712,577 50	--------	63,997 73
Imperial	London	476,634 70	--------	1,120,052 50	--------	84,361 79
Lancashire	Manchester	385,585 72	--------	1,529,450 00	--------	127,952 66
Law, Union, and Crown	London	--------	--------	633,980 00	--------	13,121 15
Lion Fire	London	4,500 00	232,577 50	481,190 00	--------	71,684 11
Liverpool and London and Globe	Liverpool	1,911,248 00	3,194,350 00	2,745,170 00	--------	883,985 49
London	London	--------	--------	1,990,973 75	--------	234,898 91
London and Lancashire	Liverpool	300,000 00	--------	1,704,654 25	--------	278,810 60
Magdeburg Fire*	Magdeburg	534,159 87	1,260,026 01	1,624,860 68	--------	544,124 88
Manchester Fire	Manchester	3,312 14	--------	1,400,880 00	--------	157,102 20
Netherlands Fire	The Hague	--------	--------	474,232 50	--------	48,563 21
New Zealand	Auckland	185,000 00	--------	277,500 00	--------	3,311 31
North British and Mercantile*	London	2,662,012 25	397,299 12	13,437,323 44	--------	557,494 31
Northern*	London	2,494,660 31	1,337,890 10	18,831,940 19	3,084,341 60	428,284 32
North German Fire	Hamburg	--------	55,000 00	371,266 25	--------	13,616 60
Norwich Union Fire*	Norwich, England	289,500 00	40,000 00	4,689,293 66	--------	777,684 71
Phœnix	London	--------	--------	2,237,026 25	--------	420,822 70
Prussian National	Stettin	800 00	--------	578,915 00	--------	91,228 52
Royal	Liverpool	2,143,090 05	195,000 00	3,798,412 55	--------	267,766 32
Royal Exchange*	London	1,192,499 60	4,956,079 45	13,159,764 15	3,764,726 80	785,335 95
Scottish Union and National	Edinburgh	218,457 56	1,064,050 17	2,040,369 95	2,600 00	520,111 72
State Fire	Liverpool	--------	--------	298,250 00	--------	8,827 97
Svea Fire and Life*	Gothenburg	504,666 67	3,394,021 02	2,080,073 42	1,223,584 98	145,980 11
Sun	London	250,000 00	188,000 00	1,655,710 00	--------	197,654 42
Thuringia*	Erfurt, Germany	464,575 00	7,724,318 35	1,737,431 24	900,344 62	165,698 76
Transatlantic Fire	Hamburg	--------	--------	554,715 00	--------	38,581 46
Union	London	200,000 00	--------	1,128,370 00	--------	121,696 22
Western	Toronto	--------	20,000 00	1,360,432 74	--------	209,388 44
Totals	--------	$15,727,007 95	$24,311,221 11	$92,616,317 95	$9,074,222 02	$8,266,173 40

*Home office statement.

TABLE NO. 34—Continued.

Name.	Location.	Interest Due and Accrued.	Premiums in Course of Collection.	Bills Receivable, Not Matured, Taken for Fire and Marine Risks.	All Other Assets.	Total Assets.
Aachen and Munich Fire	Aix-la-Chapelle, Ger.	$920 00	$95,700 47			$913,533 71
Alliance	London	4,725 00	37,440 29	$700 42		871,662 81
Atlas*	London	24,840 81	610,165 36		$8,459,734 02	12,046,535 60
Baloise Fire	Basle	1,166 67	66,159 21			836,288 72
British America	Toronto	14,338 37	231,128 38	476 28		1,310,063 19
Caledonian	Edinburgh	14,484 15	164,024 98	493 96	2,119 50	1,910,617 66
Commercial Union	London	21,318 71	493,689 26	6,293 79	155,504 22	3,881,770 52
Hamburg-Bremen	Hamburg		128,894 94			1,586,975 83
Helvetia Swiss Fire	St. Gall, Switzerland	3,291 67	87,770 47			867,637 37
Imperial	London	5,091 66	205,657 79		2,559 16	1,894,357 60
Lancashire	Manchester		265,749 15			2,308,737 53
Law, Union, and Crown	London	3,513 63	50,169 88			700,784 66
Lion Fire	London	12,362 23	82,726 86			885,040 70
Liverpool and London and Globe	Liverpool	38,434 00	1,021,193 47		10,521 56	9,804,902 52
London	London	5,889 59	201,267 22	132 78	14,514 81	2,447,677 06
London and Lancashire	Liverpool	20,630 00	317,306 19	4,861 97	14,783 08	2,641,046 09
Magdeburg Fire*	Magdeburg	7,247 86	286,408 42		493,288 59	4,750,116 31
Manchester Fire	Manchester	5,054 17	270,302 56	153 93	4,293 85	1,841,098 85
Netherlands Fire	The Hague	2,920 84	47,250 86			572,967 41
New Zealand	Auckland		25,897 38	3,808 85	829 66	496,347 20
North British and Mercantile*	London	51,600 71	344,726 00	9,215 90	1,359,769 97	18,819,441 70
Northern*	London	271,461 48	133,259 25	76,479 79	2,701,554 75	29,359,871 79
North German Fire	Hamburg	2,080 43	92,251 92		82,413 65	616,628 85
Norwich Union Fire*	Norwich, England	51,020 17	819,170 69	27,322 75		6,693,991 98
Phœnix	London	25,431 25	237,251 26		12,403 52	2,932,934 98
Prussian National	Stettin	1,577 50	97,967 62	1,097 56	117 29	771,703 49
Royal	Liverpool	41,508 33	711,129 52		30,808 24	7,187,715 01
Royal Exchange*	London	184,016 20	554,498 40	13,032 40	52,090 40	24,662,043 35
Scottish Union and National	Edinburgh	36,258 94	431,135 46			4,312,983 80
State Fire	Liverpool	1,870 83	20,756 47			329,705 27
Svea Fire and Life*	Gothenburg	73,138 98	253,565 47		287,589 50	7,962,620 15
Sun	London	19,796 48	282,597 16		1,316 67	2,595,074 73
Thuringia*	Erfurt, Germany	43,704 18	748,384 09		431,860 66	12,216,316 90
Transatlantic Fire	Hamburg		61,619 25	248 90	179 93	655,344 54
Union	London	9,919 76	183,676 58			1,643,662 56
Western	Toronto		383,269 27	43,280 34		2,016,370 79
Totals		$999,614 60	$10,044,161 55	$187,599 62	$14,118,253 03	$175,344,571 23

* Home office statement.

TABLE No. 35.—*Showing the various items composing the Liabilities, except Capital Stock, of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—Companies of Foreign Countries.*

Name.	Location.	Losses Adjusted.	Losses Unadjusted.	Losses Resisted.	Cash Dividends Remaining Unpaid.	Fire Reinsurance.
Aachen and Munich Fire	Aix-la-Chapelle	$3,848 03	$45,540 83	$4,640 99	----------	$367,756 44
Alliance	London	----------	5,287 41	----------	----------	133,310 43
Atlas*	London	271,939 42	----------	----------	----------	1,218,390 44
Baloise	Basle	15,357 88	17,502 73	3,985 68	----------	222,296 78
British America	Toronto	21,935 20	83,399 19	3,598 00	----------	658,888 48
Caledonian	Edinburgh	52,728 64	48,540 70	11,196 12	----------	919,157 28
Commercial Union	London	145,110 00	136,329 00	49,500 00	----------	2,037,786 30
Hamburg-Bremen	Hamburg	12,445 00	33,955 00	16,550 00	----------	990,395 15
Helvetia Swiss Fire	St. Gall	12,656 29	17,982 21	5,250 00	----------	260,326 13
Imperial	London	35,246 87	54,519 69	21,845 00	----------	936,022 80
Lancashire	Manchester	112,724 69	126,480 44	26,546 37	----------	1,399,103 91
Law, Union, and Crown	London	8,036 32	44,468 64	1,275 00	----------	226,174 47
Lion Fire	London	20,425 96	26,916 31	2,100 00	----------	433,812 47
Liverpool and London and Globe	Liverpool	647 24	429,951 85	83,900 00	----------	4,088,896 11
London	London	93,801 00	51,306 00	17,700 00	----------	742,097 00
London and Lancashire	Liverpool	48,524 13	70,100 70	19,009 46	----------	1,466,834 54
Magdeburg Fire*	Magdeburg	----------	533,751 68	----------	$750 00	1,951,707 10
Manchester Fire	Manchester	88,244 85	71,122 63	15,203 20	----------	1,035,248 25
Netherlands Fire	The Hague	14,946 01	16,357 32	3,875 00	----------	237,004 21
New Zealand	Auckland	----------	6,504 75	8,621 50	----------	63,748 11
North British and Mercantile*	London	575,835 98	----------	----------	28,592 83	3,096,363 05
Northern*	London	320,450 98	----------	----------	14,604 29	1,880,774 42
North German Fire	Hamburg	4,426 48	13,603 57	19,900 00	----------	287,544 43
Norwich Union Fire*	Norwich	400,730 81	----------	----------	895 50	2,797,918 82
Phœnix	London	125,789 00	167,927 12	22,225 00	----------	1,590,674 16
Prussian National	Stettin	24,752 50	15,395 47	4,350 00	----------	358,101 97
Royal	Liverpool	32,516 90	364,110 23	102,301 57	----------	3,740,658 53
Royal Exchange*	London	332,822 30	----------	----------	----------	814,559 06
Scottish Union and National	Edinburgh	76,253 81	151,411 77	12,300 00	----------	1,655,789 26
State Fire	Liverpool	3,186 89	10,296 35	----------	----------	71,669 35
Svea Fire and Life*	Gothenburg	120,000 00	----------	----------	13,520 53	681,392 00
Sun	London	54,653 44	125,893 72	13,753 00	----------	1,347,856 63
Thuringia*	Erfurt	169,474 96	----------	----------	1,125 00	623,950 82
Transatlantic Fire	Hamburg	5,537 50	23,317 33	10,727 50	----------	290,307 22
Union	London	74,203 65	96,179 65	13,450 00	----------	697,292 93
Western	Toronto	37,665 48	123,995 66	14,634 15	----------	1,070,189 53
Totals	----------	$3,316,918 21	$2,912,147 95	$508,437 54	$59,488 15	$40,393,998 58

* Home office statement.

Table No. 35—Continued.

Name.	Location.	Marine Reinsurance.	Liability Under Life Department.	All Other Claims.	Total Liabilities.	Net Surplus.
Aachen and Munich Fire	Aix-la-Chapelle			$16,029 26	$437,815 55	$475,718 16
Alliance	London			8,487 17	147,085 01	724,577 80
Atlas*	London		$8,459,734 02	113,197 74	10,063,261 62	1,263,273 98
Baloise	Basle			31,686 76	290,829 83	545,458 89
British America	Toronto	$59,435 69		53,755 09	881,011 65	429,051 54
Caledonian	Edinburgh			69,759 88	1,101,382 62	809,235 04
Commercial Union	London	62,728 51		71,816 16	2,503,269 97	1,378,500 55
Hamburg-Bremen	Hamburg			34,049 79	1,087,394 94	499,580 89
Helvetia Swiss Fire	St. Gall			42,295 49	338,510 12	529,127 25
Imperial	London			39,751 07	1,087,385 43	806,972 17
Lancashire	Manchester			45,000 00	1,709,855 41	598,882 12
Law, Union, and Crown	London			12,883 35	292,837 78	407,946 88
Lion Fire	London			28,127 60	511,382 34	373,658 36
Liverpool and London and Globe	Liverpool		84,599 09	412,179 86	5,100,174 15	4,704,728 37
London	London	35,358 13		98,405 20	1,038,667 33	1,409,009 73
London and Lancashire	Liverpool			95,667 47	1,700,136 30	940,909 79
Magdeburg Fire*	Magdeburg			288,943 39	2,775,152 17	1,224,964 14
Manchester Fire	Manchester			79,586 47	1,289,405 40	551,693 45
Netherlands Fire	The Hague			24,522 87	296,705 41	276,262 00
New Zealand	Auckland	15,260 07		11,050 49	105,184 92	391,162 28
North British and Mercantile*	London			1,185,129 41	4,885,921 27	10,496,020 43
Northern*	London		19,674,867 94	194,649 08	22,085,346 71	5,774,525 08
North German Fire	Hamburg			45,750 16	371,224 64	245,404 21
Norwich Union Fire*	Norwich			44,908 83	3,244,453 96	2,789,538 02
Phœnix	London			229,569 72	2,136,185 00	796,749 98
Prussian National	Stettin			29,772 23	432,372 17	339,331 32
Royal	Liverpool		119,902 72	339,248 85	4,698,738 80	2,488,976 21
Royal Exchange*	London	221,663 03	13,559,862 65	802,704 90	15,731,611 94	5,484,331 96
Scottish Union and National	Edinburgh			193,174 07	2,088,928 91	2,224,054 89
State Fire	Liverpool			3,640 83	88,793 42	240,911 85
Svea Fire and Life*	Gothenburg		5,363,792 89	355,763 00	6,534,468 42	894,818 40
Sun	London			72,397 03	1,614,553 82	980,520 91
Thuringia*	Erfurt		9,360,605 46	702,772 90	10,857,929 14	908,387 76
Transatlantic Fire	Hamburg			15,384 17	345,273 72	310,070 82
Union	London			38,226 05	919,352 28	724,310 28
Western	Toronto	80,593 40		50,861 99	1,377,940 21	638,430 58
Totals		$475,038 83	$56,623,364 77	$5,881,148 33	$110,170,542 36	$53,677,096 09

* Home office statement.

TABLE No. 36.—*Showing the various items composing the Incomes of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—Companies of Foreign Countries.*

Name.	Location.	Fire Premiums.	Marine Premiums.	Interest on Mortgages.	Interest and Dividends From All Sources.	From All Other Sources.	Total Income.
Aachen and Munich Fire	Aix-la-Chapelle	$542,616 61			$23,552 24	$10,410 27	$576,579 12
Alliance	London	207,384 07			19,091 93	13,687 50	240,163 50
Atlas*	London	2,180,171 38			84,694 22	34,438 69	2,299,304 29
Baloise	Basle	380,391 72			23,987 11		404,378 83
British America	Toronto	985,662 62	$223,553 14		31,114 23		1,240,329 99
Caledonian	Edinburgh	1,228,408 41			62,762 90	7,108 23	1,298,279 54
Commercial Union	London	2,494,207 08	139,949 91	$11,032 50	74,680 13	16,753 21	2,736,622 83
Hamburg-Bremen	Hamburg	1,314,009 52			53,920 89		1,367,930 41
Helvetia Swiss Fire	St. Gall	438,512 94			21,863 68		460,376 62
Imperial	London	1,286,499 47			39,555 35	217,778 29	1,543,833 11
Lancashire	Manchester	1,886,785 63			61,376 01	7,142 07	1,955,303 71
Law, Union, and Crown	London	382,725 53			20,104 29		402,829 82
Lion Fire	London	565,754 08		11,609 13	13,172 19	78 16	590,613 56
Liverpool and London and Globe	Liverpool	5,001,988 51		138,046 40	96,403 10	95,595 78	5,332,033 79
London	London	854,630 95	348,505 54		72,516 26	2,845 29	1,278,498 04
London and Lancashire	Liverpool	1,611,199 66			71,242 56	3,437 08	1,685,879 30
Magdeburg Fire*	Magdeburg	4,410,781 60		47,700 78	64,372 32	52,105 24	4,574,959 94
Manchester Fire	Manchester	1,387,250 06			52,496 72		1,439,746 78
Netherlands Fire	The Hague	453,851 81			15,368 04		469,219 85
New Zealand	Auckland	73,684 04	37,586 04		8,000 00	9,540 73	128,810 81
North British and Mercantile*	London	7,785,108 50			541,463 38	494 37	8,327,066 25
Northern*	London	3,761,548 83			951,661 63	1,749,104 67	6,462,315 13
North German Fire	Hamburg	437,588 28		4,591 27	14,808 80	69,696 88	526,685 23
Norwich Union Fire*	Norwich	4,801,579 96		1,800 00	169,183 08	83,222 64	5,055,785 68
Phœnix	London	2,281,322 08			73,210 26		2,354,532 34
Prussian National	Stettin	433,844 60	2,921 69		23,193 96	2,521 06	462,481 31
Royal	Liverpool	4,013,709 18		9,479 99	150,952 25	54,765 29	4,228,906 71
Royal Exchange*	London	2,400,569 65	649,192 00		1,374,080 30	832,678 15	5,256,520 10
Scottish Union and National	Edinburgh	1,939,994 83		60,266 72	77,651 51	2,159 82	2,080,072 88
State Fire	Liverpool	135,806 36			8,554 00		144,360 36
Svea Fire and Life*	Gothenburg	1,761,184 35		305,863 47		961,045 72	3,028,093 54
Sun	London	1,480,472 78		9,080 00	71,087 26	11,226 76	1,571,866 80
Thuringia*	Erfurt	1,250,140 81	42,545 97		386,753 16	1,595,405 49	3,274,845 43
Transatlantic Fire	Hamburg	423,411 21			17,427 28	57,839 98	498,678 47
Union	London	1,137,507 00			37,446 18	8,924 02	1,183,877 20
Western	Toronto	1,482,487 40	490,438 98	2,100 00	52,978 81		2,028,005 19
Totals		$63,212,791 51	$1,934,693 27	$601,570 26	$4,860,726 03	$5,900,005 39	$76,509,786 46

*Home office statement.

TABLE No. 37.—*Showing the various items composing the Expenditures of Fire and Fire and Marine Insurance Companies doing business in California on December 31, 1900—Companies of Foreign Countries.*

Name.	Location.	Fire Losses.	Marine Losses.	Dividends.	Brokerage and Commission.
Aachen and Munich Fire	Aix-la-Chapelle	$356,855 17			$106,872 87
Alliance	London	98,351 75			48,552 90
Atlas*	London	1,302,760 58			391,662 56
Baloise	Basle	278,981 66		$144,500 25	122,993 78
British America	Toronto	702,890 55	$165,351 76		212,424 54
Caledonian	Edinburgh	850,488 25			259,400 45
Commercial Union	London	1,768,158 11	55,175 46		491,816 07
Hamburg-Bremen	Hamburg	794,198 62			254,582 67
Helvetia Swiss Fire	St. Gall	371,796 63			120,913 23
Imperial	London	937,946 44			265,307 66
Lancashire	Manchester	1,329,273 05			342,767 38
Law, Union, and Crown	London	255,596 87			104,423 58
Lion Fire	London	359,446 23			122,440 76
Liverpool and London and Globe	Liverpool	3,331,013 05			854,883 41
London	London	515,852 65	193,751 25		201,726 17
London and Lancashire	Liverpool	921,650 01			298,187 34
Magdeburg Fire*	Magdeburg	3,047,007 43		225,000 00	800,024 97
Manchester Fire	Manchester	876,051 17			283,502 36
Netherlands Fire	The Hague	376,985 40			143,094 44
New Zealand	Auckland	40,085 00	18,071 86		13,440 16
North British and Mercantile*	London	5,063,810 75		822,037 50	1,305,396 00
Northern*	London	2,152,833 83		449,145 00	627,507 85
North German Fire	Hamburg	403,583 69			113,359 63
Norwich Union Fire*	Norwich	3,079,314 64		274,575 00	975,135 00
Phœnix	London	1,560,453 64			446,941 96
Prussian National	Stettin	291,719 96	1,221 32		98,886 26
Royal	Liverpool	2,849,593 93			665,843 12
Royal Exchange*	London	1,328,781 40	478,939 35	482,453 90	372,261 45
Scottish Union and National	Edinburgh	1,389,865 73			393,485 61
State Fire	Liverpool	88,428 20			34,274 45
Svea Fire and Life*	Gothenburg	905,807 38			537,191 94
Sun	London	1,057,922 83			341,773 88
Thuringia*	Erfurt	700,568 07	48,173 13	120,000 00	490,500 41
Transatlantic Fire	Hamburg	431,470 92			101,467 16
Union	London	801,483 52			261,708 40
Western	Toronto	1,129,766 57	289,935 26		377,247 04
Totals		$41,750,793 68	$1,250,619 39	$2,517,711 65	$12,581,997 46

* Home office statement.

TABLE No. 37—Continued.

Name.	Location.	Office Salaries.	Taxes.	All Other Expenditures.	Total Expenditures.
Aachen and Munich Fire	Aix-la-Chapelle	$69,838 80	$18,662 87	$54,140 72	$606,370 43
Alliance	London	14,235 06	3,681 31	18,997 21	183,818 23
Atlas*	London			354,679 86	2,193,603 25
Baloise	Basle	1,500 00	2,069 72	1,863 96	407,409 12
British America	Toronto	60,366 34	40,414 31	64,116 70	1,245,564 20
Caledonian	Edinburgh	90,008 27	40,320 19	82,352 15	1,322,569 31
Commercial Union	London	145,271 61	70,126 70	153,405 97	2,683,953 92
Hamburg-Bremen	Hamburg	118,111 28	40,079 44	84,375 79	1,291,347 80
Helvetia Swiss Fire	St. Gall	3,000 00	12,469 59	19,786 50	527,965 95
Imperial	London	86,401 71	67,574 72	194,926 09	1,552,156 62
Lancashire	Manchester	178,045 91	64,515 34	153,647 93	2,068,249 61
Law, Union, and Crown	London	6,877 54	11,639 27	8,631 65	387,168 91
Lion Fire	London	32,169 43	23,320 77	33,584 83	570,962 02
Liverpool and London and Globe	Liverpool	335,380 71	179,282 82	339,184 67	5,039,744 66
London	London	88,627 83	44,579 32	62,301 68	1,106,838 90
London and Lancashire	Liverpool	145,006 09	52,841 76	135,753 41	1,553,438 61
Magdeburg Fire*	Magdeburg	173,181 17	80,251 01	173,243 94	4,498,708 52
Manchester Fire	Manchester	86,602 08	60,701 73	88,398 09	1,395,255 43
Netherlands Fire	The Hague	9,271 24	13,062 73	20,269 22	562,683 03
New Zealand	Auckland	21,859 01	4,708 75	32,446 90	130,611 68
North British and Mercantile*	London	1,316,165 05	18,415 50	13,721 43	8,539,546 23
Northern*	London	743,877 83	106,673 94	1,623,986 63	5,704,025 08
North German Fire	Hamburg	23,186 42	12,434 03	40,407 33	592,971 10
Norwich Union Fire*	Norwich	383,201 90	106,159 48	278,129 27	5,096,515 29
Phœnix	London	136,331 29	76,105 75	140,008 82	2,359,841 46
Prussian National	Stettin	35,495 19	19,036 35	37,694 48	484,053 56
Royal	Liverpool	347,302 61	136,498 42	262,867 44	4,262,105 52
Royal Exchange*	London			2,127,047 30	4,789,483 40
Scottish Union and National	Edinburgh	91,960 07	84,024 90	116,283 50	2,075,619 81
State Fire	Liverpool	6,237 24	2,281 65	7,202 50	138,424 04
Svea Fire and Life*	Gothenburg	144,304 00	31,891 50	1,373,818 26	2,993,013 08
Sun	London	94,343 45	41,168 27	120,136 39	1,655,344 82
Thuringia*	Erfurt	299,394 98		1,089,335 93	2,747,972 52
Transatlantic Fire	Hamburg	28,883 53	13,331 30	48,265 39	623,418 30
Union	London	57,769 02	39,443 06	56,086 07	1,216,490 07
Western	Toronto	80,100 00	64,738 63	121,436 22	2,063,223 72
Totals		$5,454,306 66	$1,582,505 13	$9,532,534 23	$74,670,468 20

* Home office statement.

TABLE No. 38.—*Showing amount of Risks Written, Premiums Received, and amount of Risks in Force, on December 31, 1900, with Premiums thereon, of Fire and Fire and Marine Insurance Companies doing business in California—Companies of Foreign Countries.*

Name.	Location.	Risks Written During the Year.				
		Fire.	Premiums.	Marine.	Premiums.	Total Premiums.
Aachen and Munich Fire	Aix-la-Chapelle	$59,521,885 00	$766,359 55			$766,359 55
Alliance	London	21,534,111 00	265,569 77			265,569 77
Atlas*	London	1,108,722,235 00	3,507,783 71			3,507,783 71
Baloise	Basle	42,807,528 00	502,379 54			502,379 54
British America	Toronto	105,027,258 00	1,250,405 95	$36,916,882 00	$385,587 76	1,635,993 71
Caledonian	Edinburgh	156,983,363 00	1,702,843 15			1,702,843 15
Commercial Union	London	309,974,637 00	3,226,627 04	52,166,668 00	220,803 57	3,447,430 61
Hamburg-Bremen	Hamburg	132,442,173 00	1,610,706 60			1,610,706 60
Helvetia Swiss Fire	St. Gall	53,162,147 00	616,503 82			616,503 82
Imperial	London	143,730,537 00	1,657,680 46			1,657,680 46
Lancashire	Manchester	241,298,167 00	2,444,125 74			2,444,125 74
Law, Union, and Crown	London	50,199,582 00	557,435 23			557,435 23
Lion Fire	London	73,406,600 00	825,816 01			825,816 01
Liverpool and London and Globe	Liverpool	757,826,529 00	6,874,759 19			6,874,759 19
London	London	111,334,574 00	1,058,347 00	101,956,751 00	640,522 34	1,698,869 34
London and Lancashire Fire	Liverpool	275,247,277 00	2,445,221 19			2,445,221 19
Magdeburg Fire*	Magdeburg	2,893,783,103 00	7,914,868 94			7,914,868 94
Manchester Fire	Manchester	179,879,502 00	2,015,063 14			2,015,063 14
Netherlands Fire	The Hague	50,226,276 00	618,698 99			618,698 99
New Zealand	Auckland	8,050,343 00	126,775 23	3,412,984 00	45,575 05	172,350 28
North British and Mercantile*	London	3,118,249,880 00	7,734,265 75			7,734,265 75
Northern*	London	1,225,037,912 00	3,761,548 83			3,761,548 83
North German Fire	Hamburg	53,045,619 00	669,902 85			669,902 85
Norwich Union Fire*	Norwich	1,889,359,355 00	6,494,047 69			6,494,047 69
Phœnix	London	398,834,133 00	3,432,350 19			3,432,350 19
Prussian National	Stettin	56,466,585 00	653,241 65	696,771 00	2,921 69	656,163 34
Royal	Liverpool	797,441,087 00	5,966,047 56			5,966,047 56
Royal Exchange*	London	1,236,919,000 00	2,968,605 53	251,205,485 00	1,158,034 40	4,126,639 93
Scottish Union and National	Edinburgh	357,480,804 00	3,433,140 63			3,433,140 63
State Fire	Liverpool	15,629,909 00	178,282 57			178,282 57
Svea-Fire and Life*	Gothenburg	430,233,670 00	2,334,920 50			2,334,920 50
Sun	London	207,438,897 00	1,960,372 25			1,960,372 25
Thuringia*	Erfurt	843,683,015 00	2,256,424 42	47,128,846 00	103,943 91	2,360,368 33
Transatlantic Fire	Hamburg	55,987,935 00	658,926 88			658,926 88
Union	London	153,776,508 00	1,578,110 32			1,578,110 32
Western	Toronto	192,259,442 00	1,908,986 26	57,095,264 00	536,679 27	2,445,665 53
Totals		$17,807,001,578 00	$85,977,144 13	$550,579,651 00	$3,094,067 99	$89,071,212 12

*Home office statement.

TABLE No. 38—Continued.

Name.	Location.	Risks in Force on December 31, 1900.				
		Fire.	Premiums.	Marine.	Premiums.	Total Premiums.
Aachen and Munich Fire	Aix-la-Chapelle	$54,878,215 00	$713,262 99			$713,262 99
Alliance	London	20,458,925 00	274,224 50			274,224 50
Atlas*	London	705,946,773 00	2,422,812 33			2,422,812 33
Baloise	Basle	36,823,709 00	437,159 43			437,159 43
British America	Toronto	120,066,405 00	1,305,908 28	$1,970,938 00	$60,029 38	1,365,937 66
Caledonian	Edinburgh	181,595,182 00	1,821,699 45			1,821,699 45
Commercial Union	London	401,717,678 00	3,857,323 41	3,643,972 00	67,009 77	3,924,333 18
Hamburg-Bremen	Hamburg	156,180,263 00	1,906,856 76			1,906,856 76
Helvetia Swiss Fire	St. Gall	42,457,319 00	510,705 92			510,705 92
Imperial	London	172,685,969 00	1,853,812 02			1,853,812 02
Lancashire	Manchester	276,022,200 00	2,780,708 63			2,780,708 63
Law, Union, and Crown	London	39,809,886 00	438,731 18			438,731 18
Lion Fire	London	79,853,257 00	855,333 95			855,333 95
Liverpool and London and Globe	Liverpool	863,857,032 00	7,406,376 58			7,406,376 58
London	London	163,096,811 00	1,491,777 82	6,306,264 00	35,358 13	1,527,135 95
London and Lancashire Fire	Liverpool	387,853,743 00	2,987,930 29			2,987,930 29
Magdeburg Fire*	Magdeburg					
Manchester Fire	Manchester	194,146,167 00	2,068,316 17			2,068,316 17
Netherlands Fire	The Hague	36,042,707 00	449,921 45			449,921 45
New Zealand	Auckland	9,951,369 00	142,773 38	750,168 00	23,822 75	166,596 13
North British and Mercantile*	London	2,709,071,970 00	6,182,099 09			6,182,099 09
Northern*	London	816,691,942 00	2,507,699 22			2,507,699 22
North German Fire	Hamburg	43,063,876 00	566,201 84			566,201 84
Norwich Union Fire*	Norwich	1,563,557,840 00	5,467,102 50			5,467,102 50
Phœnix	London	315,819,148 00	3,139,067 92			3,139,067 92
Prussian National	Stettin	59,074,278 00	701,610 67			701,610 67
Royal	Liverpool	772,480,403 00	7,028,201 18			7,028,201 18
Royal Exchange*	London	664,580,631 00	1,594,993 46			1,594,993 46
Scottish Union and National	Edinburgh	382,670,794 00	3,341,691 46			3,341,691 46
State Fire	Liverpool	11,252,408 00	136,975 96			136,975 96
Svea Fire and Life*	Gothenburg	231,221,292 00	1,418,435 77			1,418,435 77
Sun	London	311,959,981 00	2,712,220 47			2,712,220 47
Thuringia*	Erfurt	656,534,484 00	1,196,998 44	19,276,408 00	42,545 97	1,239,544 41
Transatlantic Fire	Hamburg	42,960,411 00	563,239 45			563,239 45
Union	London	131,556,356 00	1,369,116 46			1,369,116 46
Western	Toronto	210,246,093 00	2,122,650 14	6,460,676 00	151,218 19	2,273,868 33
Totals		$12,866,185,517 00	$73,773,938 57	$38,408,426 00	$379,984 19	$74,153,922 76

*Home office statement.

TABLE No. 39.

Summary of Assets, Liabilities, Incomes, Expenditures, etc., of Marine Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Cash Capital Paid Up.	Assets.	Liabilities, Capital Not Included.	Incomes.	Expenditures.	Losses Incurred During the Year.	Net Surplus.
Alliance	Berlin	$250,000 00	$1,278,169 01	$646,725 25	$996,804 33	$912,377 78	$203,851 67	$381,443 76
Alliance Marine	London	1,000,000 00	2,988,265 00	270,735 00	786,255 00	1,029,845 00	521,840 00	1,717,530 00
American and Foreign Marine	New York	200,000 00	319,041 45	17,244 69	50,209 71	41,958 16	27,969 95	101,796 76
Baloise	Basle	200,000 00	646,826 49	230,293 20	432,080 08	437,868 25	348,565 74	216,533 29
Boston	Boston	1,000,000 00	3,421,819 12	888,896 69	1,634,940 27	1,340,191 55	478,826 01	1,532,922 43
British and Foreign Marine	Liverpool	1,302,480 00	6,864,801 34	1,350,075 96	2,646,863 26	2,822,265 87	2,115,833 93	4,212,245 38
Canton	Hong Kong	250,000 00	1,392,136 44	405,089 64	813,135 09	494,374 78	242,740 82	737,046 80
China Traders	Hong Kong	300,000 00	1,471,296 49	461,411 42	727,727 84	552,172 91	317,428 00	709,885 07
Fonciere	Paris	1,250,000 00	3,504,641 90	1,427,180 27	2,048,905 29	1,853,835 16	1,438,431 22	827,461 63
Frankfort Marine	Frankfort, Ger.	312,500 00	2,581,324 62	1,771,144 76	1,495,632 22	1,307,963 64	318,047 74	497,679 86
Helvetia General	St. Gall	400,000 00	1,391,230 19	434,327 02	504,158 80	563,508 59	380,615 80	556,903 17
Imperial Marine	Tokio	375,000 00	519,071 34	63,187 23	335,287 40	221,463 54	155,042 17	80,884 11
Indemnity Mutual Marine	London	1,005,000 00	4,407,045 53	280,208 79	1,847,994 93	1,775,647 20	1,367,205 98	3,121,836 74
London and Provincial Marine and General	London	500,000 00	1,800,901 85	299,541 05	1,240,846 15	1,007,588 45	857,851 70	1,001,360 80
Mannheim*	Mannheim		477,882 96	85,799 18	520,966 42	400,943 83	343,052 04	392,083 78
Man On	Hong Kong	500,000 00	665,102 16	76,602 95	247,284 94	236,473 29	67,538 78	88,499 21
Marine	London	900,000 00	6,251,258 12	330,640 40	1,423,151 65	1,217,002 45	684,954 40	5,020,617 72
Maritime	Liverpool	500,000 00	2,416,783 75	1,253,940 64	1,292,456 86	1,079,378 80	951,252 00	662,843 11
North China	Shanghai	600,000 00	1,113,077 14	85,524 62	545,083 80	437,359 06	173,761 62	427,552 52
Ocean Marine	London	500,000 00	2,622,157 07	237,595 00	1,111,460 00	1,024,915 00	833,125 00	1,884,562 07
Po On	Hong Kong	400,000 00	483,484 09	66,804 05	366,972 50	354,065 50	314,432 50	16,680 04
Reliance Marine	Liverpool	500,000 00	1,395,417 58	313,347 86	689,265 35	616,678 03	469,370 00	582,069 72
Sea	Liverpool	500,000 00	3,768,270 75	1,076,008 85	1,575,395 81	1,351,410 29	1,000,256 79	2,192,261 90
Standard Marine	Liverpool	500,000 00	1,640,399 00	432,829 00	526,682 00	541,493 00	479,927 00	707,570 00
Switzerland Marine	Zurich	200,000 00	983,563 89	569,107 16	558,594 59	512,987 72	406,611 07	214,456 73
Thames and Mersey	Liverpool	1,000,000 00	6,080,885 50	1,501,431 50	2,129,240 00	2,120,364 00	1,545,595 00	3,579,454 00
Union Marine	Liverpool	817,500 00	4,683,298 29	1,442,269 24	2,037,060 60	1,791,924 17	1,472,793 54	2,423,529 05
Universo Marine	Milan, Italy	300,000 00	682,024 07	342,256 66	843,460 02	721,998 41	615,575 29	39,767 41
Wilhelma	Magdeburg	750,000 00	12,250,129 24	11,024,031 37	3,492,769 39	2,116,132 37	520,851 25	476,097 87
Yangtse	Shanghai	262,800 00	966,853 45	136,758 04	420,616 13	372,231 10	225,145 38	567,295 41
Totals		$16,575,280 00	$79,067,157 83	$27,521,007 49	$33,341,300 43	$29,256,417 90	$18,878,492 39	$34,970,870 34

* United States branch statement.

TABLE NO. 40.

Showing the various items composing the Assets of Marine Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Real Estate.	Mortgage Loans.	Stocks and Bonds.	Collateral Loans.	Cash in Office and Banks.
Alliance	Berlin	$355,000 00	$125,000 00	$187,511 19		$177,746 57
Alliance Marine	London	185,000 00		2,508,515 00		57,645 00
American and Foreign Marine	New York			305,482 50		10,013 39
Baloise	Basle	22,000 00	62,000 00	329,560 50		35,223 78
Boston	Boston	20,000 00	1,035,850 00	1,689,072 05	$15,000 00	299,435 14
British and Foreign Marine	Liverpool	414,002 66	33,500 00	5,258,092 32	79,631 10	289,606 57
Canton	Hong Kong		529,660 09	406,686 33		115,308 83
China Traders	Hong Kong		383,152 78	341,224 38		576,677 57
Fonciere	Paris	590,392 33		1,525,614 36		363,617 48
Frankfort Marine	Frankfort, Germany	237,698 13	838,359 00	651,155 78		280,215 10
Helvetia General	St. Gall, Switzerland	56,000 00	393,386 60	544,743 30		166,437 45
Imperial Marine	Tokio	8,663 92	73,236 57	149,591 22		170,996 43
Indemnity Mutual Marine	London			3,792,234 00		263,708 56
London and Provincial Marine and General	London			1,154,103 40		383,037 65
Mannheim	Mannheim			358,500 00		36,007 73
Man On	Hong Kong		282,073 05			250,787 18
Marine	London	350,000 00		5,455,400 90		115,537 41
Maritime	Liverpool			1,940,257 15	50,000 00	113,637 10
North China	Shanghai	183,874 46	37,100 00	638,754 44		183,428 34
Ocean Marine	London	375,000 00		1,887,231 19		136,988 18
Po On	Hong Kong	91,454 65				278,327 69
Reliance Marine	Liverpool			1,103,070 23	35,750 00	55,734 98
Sea	Liverpool			2,924,412 70	207,500 00	158,628 27
Standard Marine	Liverpool			1,178,004 00		180,789 00
Switzerland General	Zurich			496,587 50		186,161 82
Thames and Mersey	Liverpool			5,184,763 00	90,750 00	184,156 75
Union Marine	Liverpool	97,829 73		3,549,729 78	224,498 83	58,970 99
Universo Marine	Milan, Italy			228,077 00		159,245 07
Wilhelma	Magdeburg	918,766 43	9,505,150 00	41,856 75		72,536 89
Yangtse	Shanghai		228,750 00	307,512 68		316,550 15
Totals		$3,905,682 31	$13,527,218 09	$44,137,743 65	$703,129 93	$5,677,217 07

TABLE No. 40—Continued.

Name.	Location.	Interest Due and Accrued.	Premiums in Course of Collection.	Bills Receivable, Not Matured, Taken for Marine Risks.	All Other Assets.	Total Assets.
Alliance	Berlin	$2,031 01	$430,880 24			$1,278,169 01
Alliance Marine	London	17,105 00	173,195 00	$36,805 00	$10,000 00	2,988,265 00
American and Foreign Marine	New York		3,281 56		264 00	319,041 45
Baloise	Basle	3,183 85	194,858 36			646,826 49
Boston	Boston	9,419 44	252,503 31	92,817 62	7,721 56	3,421,819 12
British and Foreign Marine	Liverpool	36,164 43	604,944 27	101,517 36	47,282 63	6,864,801 34
Canton	Hong Kong	10,361 34	330,095 65		24 20	1,392,136 44
China Traders	Hong Kong	12,736 73	84,626 66	23,533 19	49,345 18	1,471,296 49
Fonciere	Paris	13,574 41	657,543 68		353,899 64	3,504,641 90
Frankfort Marine	Frankfort, Germany		567,555 76	6,340 85		2,581,324 62
Helvetia General	St. Gall, Switzerland	15,142 82	209,274 21		6,245 81	1,391,230 19
Imperial Marine	Tokio		116,583 20			519,071 34
Indemnity Mutual Marine	London		340,414 68	8,139 54	2,548 75	4,407,045 53
London and Provincial Marine and General	London		263,760 80			1,800,901 85
Mannheim	Mannheim		82,775 23	600 00		477,882 96
Man On	Hong Kong		32,507 45		99,734 48	665,102 16
Marine	London		319,293 80	7,863 26	3,162 75	6,251,258 12
Maritime	Liverpool		309,854 68		3,034 82	2,416,783 75
North China	Shanghai	3,381 42	63,497 74	3,040 74		1,113,077 14
Ocean Marine	London	22,070 31	200,867 39			2,622,157 07
Po On	Hong Kong		4,345 00	109,356 75		483,484 09
Reliance Marine	Liverpool	12,226 32	166,826 69		21,809 36	1,395,417 58
Sea	Liverpool	2,162 52	341,826 67	3,559 72	130,180 87	3,768,270 75
Standard Marine	Liverpool	14,988 00	242,612 00	23,382 00	624 00	1,640,399 00
Switzerland General	Zurich	2,908 76	143,719 72	120,406 36	33,779 73	983,563 89
Thames and Mersey	Liverpool	66,798 00	515,784 00	35,583 75	3,050 00	6,080,885 50
Union Marine	Liverpool	37,521 98	419,204 18	97,791 88	197,750 92	4,683,298 29
Universo Marine	Milan, Italy		237,271 53	9,913 66	47,516 81	682,024 07
Wilhelma	Magdeburg	176 95	531,451 89	10,590 88	1,169,599 45	12,250,129 24
Yangtse	Shanghai	6,775 00	106,426 74		838 88	966,853 45
Totals		$288,728 29	$7,947,782 09	$691,242 56	$2,188,413 84	$79,067,157 83

TABLE No. 41.

Showing the various items composing the Liabilities, except Capital Stock, of Marine Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Losses Adjusted.	Losses Unadjusted.	Losses Resisted.	Dividends Unpaid.	Marine Reinsurance.	All Other Claims.	Total Liabilities, Capital Not Included.	Net. Surplus.
Alliance	Berlin	$258,072 85	--------	--------	$33 75	$50,953 07	$337,665 58	$646,725 25	$381,443 76
Alliance Marine	London	--------	$63,655 00	--------	4,335 00	162,385 00	40,360 00	270,735 00	1,717,530 00
American and Foreign Marine	New York	2,224 00	--------	--------	8,000 00	4,960 39	2,060 30	17,244 69	101,796 76
Baloise	Basle	145,576 20	--------	--------	--------	84,717 00	--------	230,293 20	216,533 29
Boston	Boston	1,264 13	126,104 87	--------	--------	245,393 77	516,133 92	888,896 69	1,532,922 43
British and Foreign Marine	Liverpool	--------	531,868 68	--------	2,590 14	679,297 09	136,320 05	1,350,075 96	4,212,245 38
Canton	Hong Kong	167,420 00	51,674 00	$25,997 00	1,508 50	83,855 00	74,635 14	405,089 64	737,046 80
China Traders	Hong Kong	--------	144,566 00	--------	7,872 75	172,357 55	136,615 12	461,411 42	709,885 07
Fonciere	Paris	652,466 00	--------	--------	4,189 50	419,913 52	350,611 25	1,427,180 27	827,461 63
Frankfort Marine	Frankfort, Ger.	281,708 88	--------	--------	--------	62,372 25	1,427,063 63	1,771,144 76	497,679 86
Helvetia General	St. Gall	216,019 42	--------	--------	160 00	102,678 33	115,469 27	434,327 02	556,903 17
Imperial Marine	Tokio	53,411 12	--------	--------	329 25	9,446 86	--------	63,187 23	80,884 11
Indemnity Mutual Marine	London	31,605 79	--------	--------	1,103 00	247,500 00	--------	280,208 79	3,121,836 74
London and Provincial Marine and General	London	--------	17,500 00	7,875 00	1,829 05	208,965 85	63,371 15	299,541 05	1,001,360 80
Mannheim	Mannheim	--------	39,802 95	--------	--------	31,812 00	14,184 23	85,799 18	392,083 78
Man On	Hong Kong	12,600 00	--------	--------	60,000 00	4,002 95	--------	76,602 95	88,499 21
Marine	London	2,553 15	8,470 00	--------	--------	117,815 00	201,802 25	330,640 40	5,020,617 72
Maritime	Liverpool	516,755 00	--------	--------	1,645 00	677,155 00	58,385 64	1,253,940 64	662,843 11
North China	Shanghai	--------	28,000 00	--------	1,980 84	54,793 78	750 00	85,524 62	427,552 52
Ocean Marine	London	26,040 00	17,675 00	--------	--------	193,880 00	--------	237,595 00	1,884,562 07
Po On	Hong Kong	4,564 00	8,089 00	--------	345 00	12,325 00	41,481 05	66,804 05	16,680 04
Reliance Marine	Liverpool	143,845 00	--------	--------	110 50	144,873 94	24,518 42	313,347 86	582,069 72
Sea	Liverpool	9,090 24	611,094 76	--------	330 00	364,085 75	91,408 10	1,076,008 85	2,192,261 90
Standard Marine	Liverpool	--------	172,950 00	--------	--------	142,745 00	117,134 00	432,829 00	707,570 00
Switzerland Marine	Zurich	215,231 80	--------	--------	60 00	145,999 38	207,815 98	569,107 16	214,456 73
Thames and Mersey	Liverpool	413,550 00	--------	--------	3,125 25	1,026,685 00	58,071 25	1,501,431 50	3,579,454 00
Union Marine	Liverpool	496,100 00	--------	--------	884 75	367,065 81	578,218 68	1,442,269 24	2,423,529 05
Universo Marine	Milan, Italy	177,936 30	--------	--------	--------	148,785 30	15,535 06	342,256 66	39,767 41
Wilhelma	Magdeburg	--------	94,868 50	--------	518 25	107,573 50	10,821,071 12	11,024,031 37	476,097 87
Yangtse	Shanghai	24,560 00	45,940 00	--------	1,708 04	27,500 00	37,050 00	136,758 04	567,295 41
Totals	--------	$3,852,593 88	$1,962,258 76	$33,872 00	$102,658 57	$6,101,893 09	$15,467,731 19	$27,521,007 49	$34,970,870 34

TABLE No. 42.

Showing the various items composing the Incomes of Marine Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Marine Premiums.	Interest on Mortgage Loans.	Interest and Dividends from All Other Sources.	From Other Sources.	Total Income.
Alliance	Berlin	$306,134 46	$468 75	$26,947 21	$663,253 91	$996,804 33
Alliance Marine	London	704,305 00		81,950 00		786,255 00
American and Foreign Marine	New York	41,210 27		8,999 44		50,209 71
Baloise	Basle	415,138 01		16,942 07		432,080 08
Boston	Boston	876,742 77	39,258 53	69,284 35	649,654 62	1,634,940 27
British and Foreign Marine	Liverpool	2,410,101 01		192,332 35	44,429 90	2,646,863 26
Canton	Hong Kong	803,402 40	2,365 22	7,329 77	37 70	813,135 09
China Traders	Hong Kong	677,660 18	26,565 46	23,431 57	70 63	727,727 84
Fonciere	Paris	1,947,105 52		68,986 17	32,813 60	2,048,905 29
Frankfort Marine	Frankfort, Ger.	393,984 04		43,656 36	1,057,991 82	1,495,632 22
Helvetia General	St. Gall	464,682 58	15,336 55	24,139 67		504,158 80
Imperial Marine	Tokio	297,271 00		37,768 82	247 58	335,287 40
Indemnity Mutual Marine	London	1,711,222 94		136,611 99	160 00	1,847,994 93
London and Provincial Marine and General	London	1,174,104 25		66,741 90		1,240,846 15
Mannheim	Mannheim	514,966 42			6,000 00	520,966 42
Man On	Hong Kong	201,472 57	18,281 52	15,278 04	12,252 81	247,284 94
Marine	London	1,256,485 40		166,666 25		1,423,151 65
Maritime	Liverpool	1,226,711 73		65,676 13	69 00	1,292,456 86
North China	Shanghai	505,364 41	4,051 75	35,622 14	45 50	545,083 80
Ocean Marine	London	1,036,405 00		61,005 00	14,050 00	1,111,460 00
Po On	Hong Kong	336,249 00		19,643 50	11,080 00	366,972 50
Reliance Marine	Liverpool	653,040 37		36,153 73	71 25	689,265 35
Sea	Liverpool	1,467,848 67		107,028 83	518 31	1,575,395 81
Standard Marine	Liverpool	487,646 00		39,036 00		526,682 00
Switzerland Marine	Zurich	535,895 34		21,455 89	1,243 36	558,594 59
Thames and Mersey	Liverpool	1,921,701 50		163,140 75	44,397 75	2,129,240 00
Union Marine	Liverpool	1,906,864 00		130,057 85	138 75	2,037,060 60
Universo Marine	Milan, Italy	828,041 46		15,418 56		843,460 02
Wilhelma	Magdeburg	575,673 98	360,500 65	58,558 36	2,498,036 40	3,492,769 39
Yangtse	Shanghai	382,145 75	16,969 24	21,476 14	25 00	420,616 13
Totals		$26,059,576 03	$483,797 67	$1,761,338 84	$5,036,587 89	$33,341,300 43

TABLE No. 43.

Showing the various items composing the Expenditures of Marine Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Marine Losses.	ividends.	Brokerage and Commissions.	Office Salaries.	Taxes.	All Other Expenditures.	Total Expenditures.
Alliance	Berlin	$203,851 67	$50,000 00	$306,444 42	----	$2,853 73	$349,227 96	$912,377 78
Alliance Marine	London	744,420 00	98,710 00	17,765 00	$125,680 00	9,780 00	33,490 00	1,029,845 00
American and Foreign Marine	New York	31,099 95	8,000 00	1,576 88	783 49	497 84	----	41,958 16
Baloise	Basle	348,565 74	12,000 00	40,022 39	----	----	37,280 12	437,868 25
Boston	Boston	379,046 61	100,000 00	222,390 36	125,843 36	26,043 15	486,868 07	1,340,191 55
British and Foreign Marine	Liverpool	2,115,833 93	325,620 00	11,254 42	282,416 93	60,625 28	26,515 31	2,822,265 87
Canton	Hong Kong	242,740 82	----	27,992 07	41,660 41	----	181,981 48	494,374 78
China Traders	Hong Kong	317,428 00	73,107 68	24,232 20	108,942 65	----	28,462 38	552,172 91
Fonciere	Paris	1,438,431 22	----	246,744 20	149,770 18	----	18,889 56	1,853,835 16
Frankfort Marine	Frankfort, Ger.	318,047 74	81,250 00	385,574 07	84,900 02	6,285 26	431,906 55	1,307,963 64
Helvetia General	St. Gall	380,615 80	79,840 00	47,602 72	30,958 94	7,452 62	17,038 51	563,508 59
Imperial Marine	Tokio	155,042 17	18,750 00	16,515 56	28,175 49	----	2,980 32	221,463 54
Indemnity Mutual Marine	London	1,367,205 98	199,897 00	----	77,253 33	----	131,290 89	1,775,647 20
London and Provincial Marine and General	London	891,236 70	50,000 00	----	49,354 70	----	16,997 05	1,007,588 45
Mannheim	Mannheim	272,817 79	----	63,587 64	18,338 64	14,391 56	31,808 20	400,943 83
Man On	Hong Kong	67,538 78	60,000 00	----	49,743 22	----	59,191 29	236,473 29
Marine	London	684,954 40	400,000 00	----	92,924 70	19,445 75	19,677 60	1,217,002 45
Maritime	Liverpool	940,907 60	50,000 00	20,520 54	31,703 54	1,595 98	34,651 14	1,079,378 80
North China	Shanghai	245,514 89	87,008 36	9,231 14	87,950 04	1,719 85	5,934 78	437,359 06
Ocean Marine	London	833,125 00	100,000 00	----	----	----	91,790 00	1,024,915 00
Po On	Hong Hong	278,739 00	40,000 00	----	----	----	35,326 50	354,065 50
Reliance Marine	Liverpool	465,903 45	50,000 00	----	94,063 21	6,711 37	----	616,678 03
Sea	Liverpool	1,108,808 99	99,780 00	22,660 74	95,686 95	24,473 61	----	1,351,410 29
Standard Marine	Liverpool	495,527 00	----	----	35,221 53	9,067 47	1,677 00	541,493 00
Switzerland Marine	Zurich	406,611 07	----	42,519 37	42,246 79	6,227 03	15,383 46	512,987 72
Thames and Mersey	Liverpool	1,688,035 50	199,609 00	----	159,305 55	17,455 40	55,958 55	2,120,364 00
Union Marine	Liverpool	1,472,793 54	122,625 00	6,902 69	137,724 21	20,793 52	31,085 21	1,791,924 17
Universo Marine	Milan, Italy	615,575 29	----	----	104,311 85	2,111 27	----	721,998 41
Wilhelma	Magdeburg	498,938 53	----	85,740 00	28,763 38	3,319 26	1,499,371 20	2,116,132 37
Yangtse	Shanghai	225,145 38	53,280 00	16,879 92	38,149 60	1,345 75	37,430 45	372,231 10
Totals	----	$19,234,502 54	$2,359,477 04	$1,616,156 33	$2,121,872 71	$242,195 70	$3,682,213 58	$29,256,417 90

TABLE No. 44.

Showing the amount of Risks Written, Premiums Received, and the amount of Risks in Force on December 31, 1900, with Premiums thereon, of Marine Companies doing business in California.

Name.	Location.	Risks Written.	Premiums.	Risks in Force December 31, 1900.	Premiums.
Alliance	Berlin	$152,932,470 00	$1,452,858 52	$8,057,910 00	$50,953 07
Alliance Marine	London	325,520,715 00	1,198,200 00	44,150,960 00	247,295 00
American and Foreign Marine	New York	59,553,926 00	43,842 39	686,063 00	4,960 39
Baloise	Basle	501,756,699 00	619,211 26	22,161,065 00	84,717 00
Boston	Boston	163,376,724 00	1,116,152 76	6,208,071 00	403,461 98
British and Foreign Marine	Liverpool	1,206,225,799 00	4,457,023 38	53,896,635 00	1,383,161 16
Canton	Hong Kong	201,556,447 00	954,276 11	28,027,923 00	100,821 98
China Traders	Hong Kong	204,604,570 00	1,033,479 38	33,811,185 00	172,357 55
Fonciere	Paris				
Frankfort Marine	Frankfort, Ger.				
Helvetia General	St. Gall	506,517,484 00	801,984 84	7,869,703 00	102,678 33
Imperial Marine	Tokio	58,237,560 00	367,456 85	1,683,207 00	26,789 20
Indemnity Mutual Marine	London	432,801,270 00	2,222,336 00	30,196,517 00	324,376 00
London and Provincial	London	207,269,060 00	1,824,628 55	28,182,850 00	208,965 85
Mannheim*	Mannheim	180,621,274 00	605,856 88	9,785,680 00	31,812 00
Man On	Hong Kong	83,259,970 00	206,773 73	3,335,793 00	8,005 91
Marine	London	1,157,375,000 00	1,610,454 60	30,375,000 00	206,565 00
Maritime	Liverpool	251,027,605 00	1,252,145 00	47,386,040 00	677,155 00
North China	Shanghai				
Ocean Marine	London	197,042,865 00	1,301,500 00	36,751,350 00	891,155 00
Po On	Hong Kong	131,467,550 00	354,850 00	13,510,263 00	49,267 50
Reliance Marine	Liverpool	177,220,575 00	833,779 12	11,166,040 00	144,873 93
Sea	Liverpool	215,179,065 00	1,400,329 96	22,664,320 00	364,085 75
Standard Marine	Liverpool	64,495,935 00	587,586 00	8,271,210 00	142,745 00
Switzerland Marine	Zurich	416,318,807 00	1,194,960 53	44,742,858 00	145,999 38
Thames and Mersey	Liverpool	517,059,675 00	3,432,019 25	82,330,280 00	1,383,870 00
Union Marine	Liverpool	376,782,570 00	3,717,296 63	45,401,370 00	667,256 88
Universo Marine	Milan, Italy				
Wilhelma	Magdeburg	229,284,339 00	669,921 67	8,988,304 00	107,573 50
Yangtse	Shanghai	107,589,830 00	489,475 16	1,833,330 00	27,500 00
Totals		$8,125,077,784 00	$33,748,398 57	$631,463,927 00	$7,958,402 36

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* United States branch statement.

TABLE No. 45—RECAPITULATION.

Summary of Assets, Liabilities, Income, Expenditures, etc., of Fire and Marine Insurance Companies doing business in California on December 31, 1900.

	Paid Up Capital.	Assets.	Liabilities.	Income.	Expenditures.	Losses Incurred during the Year.	Net Surplus.
California companies	$1,300,000 00	$5,051,391 15	$2,084,379 06	$2,658,746 20	$2,573,538 60	$1,502,130 23	$1,667,012 09
Companies of other States	36,702,875 00	178,300,408 81	82,824,375 13	85,093,343 31	83,575,940 28	48,825,821 84	58,773,158 68
Companies of foreign countries	11,496,932 78	175,344,571 23	110,170,542 36	76,509,786 46	74,670,468 20	42,307,485 04	53,677,096 09
Marine companies	16,575,280 00	79,067,157 83	27,521,007 49	33,341,300 43	29,256,417 90	18,878,492 39	34,970,870 34
Totals	$66,075,087 78	$437,763,529 02	$222,600,304 04	$197,603,176 40	$190,076,364 98	$111,513,929 50	$149,088,137 20

TABLE No. 46—RECAPITULATION.

Showing the various items composing the Assets of Fire and Marine Insurance Companies doing business in California on December 31, 1900.

	Real Estate.	Mortgage Loans.	Stocks and Bonds Owned.	Collateral Loans.	Cash in Office and Banks.
California companies	$797,950 00	$520,106 64	$2,590,348 00	$226,600 00	$268,847 71
Companies of other States	14,353,437 99	19,486,584 98	118,561,778 42	1,455,321 93	9,616,892 02
Companies of foreign countries	15,727,007 95	24,311,221 11	92,616,317 95	9,074,222 02	8,266,173 40
Marine companies	3,905,682 31	13,527,218 09	44,137,743 65	703,129 93	5,677,217 07
Totals	$34,784,078 25	$57,845,130 82	$257,906,188 02	$11,459,273 88	$23,829,130 20

	Interest Due and Accrued.	Premiums in Course of Collection.	Bills Receivable, Not Matured, Taken for Risks.	All Other Assets.	Total Assets.
California companies	$11,727 59	$619,875 75	----------------	$15,935 46	$5,051,391 15
Companies of other States	780,582 41	13,277,650 75	$402,380 40	365,779 91	178,300,408 81
Companies of foreign countries	999,614 60	10,044,161 55	187,599 62	14,118,253 03	175,344,571 23
Marine companies	288,728 29	7,947,782 09	691,242 56	2,188,413 84	79,067,157 83
Totals	$2,080,652 89	$31,889,470 14	$1,281,222 58	$16,688,382 24	$437,763,529 02

TABLE NO. 47—RECAPITULATION.

Showing the various items composing the Liabilities of Fire and Marine Insurance Companies doing business in California on December 31, 1900.

	Losses Adjusted.	Losses Unadjusted.	Losses Resisted.	Dividends Unpaid.	Fire Reinsurance.
California companies	$33,872 84	$171,486 69	$5,825 00	----------	$1,653,761 68
Companies of other States	2,097,694 06	4,989,798 41	656,465 48	$19,490 35	70,111,843 45
Companies of foreign countries	3,316,918 21	2,912,147 95	508,437 54	59,488 15	40,393,998 58
Marine companies	3,852,593 88	1,962,258 76	33,872 00	102,658 57	----------
Totals	$9,301,078 99	$10,035,691 81	$1,204,600 02	$181,637 07	$112,159,603 71

	Marine Reinsurance.	All Other Claims.	Total Liabilities.	Net Surplus.
California companies	$121,133 24	$98,299 61	$2,084,379 06	$1,667,012 09
Companies of other States	1,144,255 35	3,804,828 03	82,824,375 13	58,773,158 68
Companies of foreign countries	475,038 83	62,504,513 10	110,170,542 36	53,677,096 09
Marine companies	6,101,893 09	15,467,731 19	27,521,007 49	34,970,870 34
Totals	$7,842,320 51	$81,875,371 93	$222,600,304 04	$149,088,137 20

TABLE NO. 48—RECAPITULATION.

Showing the various items composing the Incomes of Fire and Marine Insurance Companies doing business in California on December 31, 1900.

	Fire Premiums.	Marine Premiums.	Interest on Mortgages.	Interest on Stocks and Bonds.	Rents.	All Other Sources.	Total Income.
California companies	$2,023,711 49	$413,708 70	$48,315 43	$135,101 27	$37,909 31	--------	$2,658,746 20
Companies of other States	74,391,979 78	3,448,175 89	1,142,786 08	4,998,249 07	501,309 63	$610,842 86	85,093,343 31
Companies of foreign countries	63,212,791 51	1,934,693 27	601,570 26	4,860,726 03	--------	5,900,005 39	76,509,786 46
Marine companies	--------	26,059,576 03	483,797 67	1,761,338 84	--------	5,036,587 89	33,341,300 43
Totals	$139,628,482 78	$31,856,153 89	$2,276,469 44	$11,755,415 21	$539,218 94	$11,547,436 14	$197,603,176 40

TABLE NO. 49—RECAPITULATION.

Showing the various items composing the Expenditures of Fire and Marine Insurance Companies doing business in California on December 31, 1900.

	Fire Losses.	Marine Losses.	Dividends.	Commissions and Brokerage.	Office Salaries.	Taxes.	All Other Expenditures.	Total Expenditures.
California companies	$1,223,852 06	$253,300 52	$156,000 00	$335,695 45	$302,563 78	$81,176 95	$220,949 84	$2,573,538 60
Companies of other States	45,861,237 19	2,090,964 75	4,980,189 75	15,458,038 54	5,847,787 45	2,584,874 78	6,752,847 82	83,575,940 28
Companies of foreign countries	41,750,793 68	1,250,619 39	2,517,711 65	12,581,997 46	5,454,306 66	1,582,505 13	9,532,534 23	74,670,468 20
Marine companies	--------	19,234,502 54	2,359,477 04	1,616,156 33	2,121,872 71	242,195 70	3,682,213 58	29,256,417 90
Totals	$88,835,882 93	$22,829,387 20	$10,013,378 44	$29,991,887 78	$13,726,530 60	$4,490,752 56	$20,188,545 47	$190,076,364 98

TABLE No. 50—RECAPITULATION.

Showing amount of Risks Written, Premiums Received, and amount of Risks in Force on December 31, 1900, with Premiums thereon, of Fire and Marine Insurance Companies doing business in California.

	RISKS WRITTEN DURING THE YEAR.				
	Fire.	Premiums.	Marine.	Premiums.	Total Premiums.
California companies	$238,586,557 00	$2,912,058 83	$113,723,568 00	$968,688 59	$3,880,747 42
Companies of other States	9,853,810,884 00	100,269,183 18	901,555,184 00	4,708,599 25	104,977,782 43
Companies of foreign countries	17,807,001,578 00	85,977,144 13	550,579,651 00	3,094,067 99	89,071,212 12
Marine companies			8,125,077,784 00	33,748,398 57	33,748,398 57
Totals	$27,899,399,019 00	$189,158,386 14	$9,690,936,187 00	$42,519,754 40	$231,678,140 54

	RISKS IN FORCE DECEMBER 31, 1900.				
	Fire.	Premiums.	Marine.	Premiums.	Total Premiums.
California companies	$269,323,470 00	$3,287,480 22	$6,461,855 00	$211,779 36	$3,499,259 58
Companies of other States	12,369,341,224 00	125,410,553 77	39,123,367 00	1,295,948 90	126,706,502 67
Companies of foreign countries	12,866,185,517 00	73,773,938 57	38,408,426 00	379,984 19	74,153,922 76
Marine companies			631,463,927 00	7,958,402 36	7,958,402 36
Totals	$25,504,850,211 00	$202,471,972 56	$715,457,575 00	$9,846,114 81	$212,318,087 37

TABLE No. 51.

Showing the various items composing the Assets of Life Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Real Estate.	Loans on Mortgages.	Collateral Loans.	Premium Notes.	Stocks and Bonds.
Ætna Life	Hartford	$469,086 71	$24,107,274 86	$918,308 67	$461,213 15	$19,487,133 91
Connecticut Mutual Life	Hartford	12,054,396 47	26,469,472 96	2,300 00	763,861 90	23,523,810 30
Conservative Life	Los Angeles	----------	29,000 00	154 18	----------	----------
Equitable Life	New York	38,188,725 12	45,411,662 86	25,371,587 00	----------	160,792,803 00
Fidelity Mutual Life	Philadelphia	1,296,066 08	229,450 35	23,986 57	93,839 31	918,855 40
Germania Life	New York	2,717,831 18	14,296,062 43	----------	----------	7,543,600 99
Home Life	New York	1,740,748 54	3,708,785 00	33,500 00	507,636 43	5,141,104 96
Manhattan Life	New York	3,996,757 72	5,529,109 30	1,524,029 72	403,053 02	3,574,591 00
Massachusetts Mutual Life	Springfield	591,205 71	10,183,402 39	----------	725,101 63	10,408,289 89
Mutual Life	New York	23,575,840 73	77,235,867 38	12,170,000 00	----------	183,368,624 91
Mutual Benefit Life	Newark	3,086,171 22	36,048,879 34	5,312,450 00	4,642,834 69	16,247,435 89
National Life	Montpelier	1,819,450 25	6,289,004 19	34,750 00	685,345 74	7,454,600 68
New England Mutual Life	Boston	2,376,526 64	8,150,238 69	2,233,870 00	256,377 81	15,408,777 00
New York Life	New York	16,925,900 00	34,798,942 34	2,894,000 00	2,133,364 58	170,354,973 41
Northwestern Mutual Life	Milwaukee	4,608,521 64	72,484,397 47	----------	285,648 93	47,428,727 41
Pacific Mutual Life	San Francisco	922,985 14	724,839 79	----------	35,256 80	1,736,526 90
Penn Mutual Life	Philadelphia	2,611,747 49	15,882,579 23	4,402,748 03	1,069,003 34	14,122,745 00
Phœnix Mutual Life	Hartford	1,017,625 19	6,780,531 98	1,000 00	303,416 57	3,850,945 24
Provident Savings Life	New York	467,157 61	423,200 00	20,705 13	719,525 60	837,490 53
Security Trust and Life	Philadelphia	952,500 00	100,800 00	----------	44,445 01	90,025 84
Travelers	Hartford	2,071,534 51	5,950,339 28	1,182,450 00	----------	17,436,404 25
Union Central Life	Cincinnati	414,550 89	20,538,620 16	----------	1,046,693 98	177,800 00
Union Mutual Life	Portland	1,184,741 98	1,272,791 43	633,671 94	179,633 43	4,792,942 78
Washington Life	New York	5,712,250 00	7,688,200 00	----------	----------	680,316 83
Totals	----------	$128,802,320 82	$424,333,451 43	$56,759,511 24	$14,356,251 92	$715,378,526 12

TABLE No. 51—Continued.

Name.	Location.	Cash in Office and Banks.	Interest Due and Accrued.	Net Uncollected Premiums.	All Other Admitted Assets.	Total Assets.
Ætna Life	Hartford	$7,323,806 89	$765,886 61	$654,477 52	$1,907,348 99	$56,094,537 31
Connecticut Mutual Life	Hartford	826,974 00	980,591 12	322,521 35	21,248 05	64,965,176 15
Conservative Life	Los Angeles	89,557 53	183 35			118,895 06
Equitable Life	New York	17,718,576 56	2,463,997 33	6,517,450 00	7,609,078 48	304,073,880 35
Fidelity Mutual Life	Philadelphia	165,948 72	17,434 97	408,715 93	224,541 80	3,378,839 13
Germania Life	New York	627,180 30	309,058 89	488,387 75	1,396,411 76	27,378,533 30
Home Life	New York	348,500 82	61,665 46	221,921 58	578,383 98	12,342,246 77
Manhattan Life	New York	167,159 90	141,608 17	183,707 46	649,806 81	16,169,823 10
Massachusetts Mutual Life	Springfield	988,108 55	370,567 43	674,210 37	2,304,736 07	26,245,622 04
Mutual Life	New York	13,299,316 32	2,703,512 98	4,660,472 59	8,739,517 60	325,753,152 51
Mutual Benefit Life	Newark	934,770 30	1,180,850 56	821,108 83	6,040,589 20	74,315,090 03
National Life	Montpelier	724,154 54	363,808 47	471,188 02	2,053,200 13	19,895,502 02
New England Mutual Life	Boston	591,011 91	174,193 45	535,073 52	1,198,903 39	30,924,972 41
New York Life	New York	14,070,177 02	1,651,649 93	4,955,981 00	14,411,523 95	262,196,512 23
Northwestern Mutual Life	Milwaukee	3,890,437 60	1,975,470 85	1,630,973 58	7,207,988 83	139,512,166 31
Pacific Mutual Life	San Francisco	128,315 69	37,367 42	162,458 15	311,622 12	4,059,372 01
Penn Mutual Life	Philadelphia	777,774 63	393,355 64	1,008,750 13	3,582,279 30	43,850,982 79
Phœnix Mutual Life	Hartford	422,549 55	142,304 72	230,177 68	534,457 00	13,283,007 93
Provident Savings Life	New York	468,528 18	58,899 49	576,093 00	318,856 31	3,890,455 85
Security Trust and Life	Philadelphia	176,149 26	3,521 36	92,717 97	20,398 79	1,480,558 23
Travelers	Hartford	1,782,773 13	275,551 52	642,626 63	1,596,652 20	30,938,331 52
Union Central Life	Cincinnati	426,268 34	815,890 47	209,569 60	2,472,520 98	26,101,914 42
Union Mutual Life	Portland	48,353 13	67,758 65	247,567 02	19,988 73	8,447,449 09
Washington Life	New York	493,621 99	124,333 34	292,432 21	1,153,279 10	16,144,433 47
Totals		$66,490,014 86	$15,079,462 18	$26,008,581 89	$64,353,333 57	$1,511,561,454 03

TABLE No. 52.

Showing the various items composing the Liabilities, Capital Stock not included, of Life Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Losses Adjusted and in Process of Adjustment.	Losses Resisted.	Net Value of Outstanding Policies (Combined Experience Table—Int. 4 Per Cent).	Unpaid Dividends Due Policy Holders.	All Other Liabilities.	Total Liabilities.	Surplus as Regards Policy Holders.
Ætna Life	Hartford	$198,187 00	$11,579 00	$46,817,308 00	$750,340 38	$2,504,538 53	$50,281,952 91	$5,812,584 40
Connecticut Mutual Life	Hartford	214,042 50	33,211 33	56,321,159 00	977,966 15	227,448 73	57,773,827 71	7,191,348 44
Conservative Life	Los Angeles	2,500 00	----------	27,690 00	----------	----------	30,190 00	88,705 06
Equitable Life	New York	2,067,225 47	138,000 00	235,032,907 00	346,195 01	565,980 00	238,150,307 48	65,923,572 87
Fidelity Mutual Life	Philadelphia	163,935 00	33,000 00	2,509,819 00	194 51	101,445 44	2,808,393 95	570,445 18
Germania Life	New York	141,939 98	13,312 34	23,623,304 00	60,299 88	101,660 18	23,940,516 38	3,438,016 92
Home Life	New York	64,369 00	29,000 00	10,869,049 00	4,368 91	92,871 56	11,059,658 47	1,282,588 30
Manhattan Life	New York	111,544 33	27,200 00	14,364,642 00	17,073 56	140,320 82	14,660,780 71	1,509,042 39
Massachusetts Mutual Life	Springfield	134,844 00	----------	23,402,526 00	172,333 76	195,776 77	23,905,480 53	2,340,141 51
Mutual Life	New York	1,497,349 09	50,811 00	266,502,266 00	90,182 66	55,172,543 76	323,313,152 51	2,440,000 00
Mutual Benefit Life	Newark	399,403 25	36,000 00	67,178,260 00	294,829 33	277,610 76	68,186,103 34	6,128,986 69
National Life	Montpelier	38,980 92	5,000 00	17,346,485 82	8,960 22	498,569 78	17,897,996 74	1,997,495 28
New England Mutual Life	Boston	137,029 00	18,337 00	27,550,121 00	155,153 93	----------	27,860,640 93	3,064,331 48
New York Life	New York	1,996,911 18	83,750 00	213,032,202 00	184,411 36	46,899,237 69	262,196,512 23	----------
Northwestern Mutual Life	Milwaukee	467,473 18	76,848 83	108,932,086 00	213,993 49	24,255,112 17	133,945,513 67	5,566,652 64
Pacific Mutual Life	San Francisco	30,106 50	19,000 00	3,502,095 00	----------	180,631 07	3,731,832 57	327,539 44
Penn Mutual Life	Philadelphia	182,406 76	----------	37,034,484 00	65,393 36	3,354,206 95	40,636,491 07	3,214,491 72
Phœnix Mutual Life	Hartford	34,593 00	----------	12,512,039 00	----------	168,591 00	12,715,223 00	567,784 93
Provident Savings Life	New York	113,860 00	50,500 00	3,236,560 00	----------	23,142 61	3,424,062 61	466,393 24
Security Trust and Life	Philadelphia	64,980 00	31,600 00	756,417 00	----------	79,494 39	932,491 39	548,066 84
Travelers	Hartford	270,005 45	98,031 30	22,311,963 74	----------	3,066,506 22	25,846,506 71	5,091,824 81
Union Central Life	Cincinnati	70,286 00	59,948 00	22,321,592 00	11,109 51	128,739 78	22,591,675 29	3,510,239 13
Union Mutual Life	Portland	98,727 42	----------	7,771,135 00	4,072 51	27,027 83	7,900,962 76	546,486 33
Washington Life	New York	126,807 55	----------	15,255,021 00	----------	7,720 48	15,389,549 03	754,884 44
Totals	----------	$8,627,506 58	$815,128 80	$1,238,211,131 56	$3,356,878 53	$138,069,176 52	$1,389,179,821 99	$122,381,632 04

TABLE No. 53.

Showing the various items composing the Incomes of Life Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Premiums.	Interest.	Rents.	All Other Sources.	Total Income.
Ætna Life	Hartford	$7,151,216 06	$2,306,272 74	$36,097 33	$1,117,459 03	$10,611,045 16
Connecticut Mutual Life	Hartford	5,086,064 36	2,553,197 78	407,481 19	793 00	8,047,536 33
Conservative Life	Los Angeles	17,376 11	794 81	----------	23,557 04	41,727 96
Equitable Life	New York	45,319,138 69	10,206,405 72	2,049,262 23	432,324 34	58,007,130 98
Fidelity Mutual Life	Philadelphia	2,168,965 31	82,782 29	70,317 03	11,097 29	2,333,161 92
Germania Life	New York	3,455,377 15	1,076,525 14	172,805 97	6,081 74	4,710,790 00
Home Life	New York	2,035,814 92	478,741 09	73,424 31	323 60	2,588,303 92
Manhattan Life	New York	1,961,691 65	552,022 89	220,150 38	60,736 53	2,794,601 45
Massachusetts Mutual Life	Springfield	4,730,207 64	1,033,451 08	39,184 06	23,567 02	5,826,409 80
Mutual Life	New York	47,211,171 38	11,728,548 26	1,062,277 51	580,805 16	60,582,802 31
Mutual Benefit Life	Newark	10,411,362 11	3,277,571 33	185,238 36	68,410 92	13,942,582 72
National Life	Montpelier	3,923,854 89	709,704 22	123,394 55	----------	4,756,953 66
New England Mutual Life	Boston	4,059,410 33	1,173,876 67	139,881 93	----------	5,373,168 93
New York Life	New York	48,758,578 13	9,577,767 26	952,564 76	48,814 74	59,337,724 89
Northwestern Mutual Life	Milwaukee	20,934,757 36	5,751,067 71	402,043 52	62,935 58	27,150,804 17
Pacific Mutual Life	San Francisco	1,374,521 52	126,291 30	33,409 38	498,013 53	2,032,235 73
Penn Mutual Life	Philadelphia	8,821,538 65	1,858,852 81	193,949 86	61,640 18	10,935,981 50
Phœnix Mutual Life	Hartford	2,542,092 80	591,753 04	52,667 34	17,699 63	3,204,212 81
Provident Savings Life	New York	3,421,058 59	89,706 37	25,236 98	35,886 03	3,571,887 97
Security Trust and Life	Philadelphia	680,969 57	14,979 28	134,772 39	67,484 59	898,205 83
Travelers	Hartford	6,774,400 46	1,229,986 89	109,040 99	71,401 82	8,184,830 16
Union Central Life	Cincinnati	4,842,779 69	1,411,001 11	30,552 81	4,935 25	6,289,268 86
Union Mutual Life	Portland	1,575,176 25	290,009 69	21,273 58	73,422 49	1,959,882 01
Washington Life	New York	2,488,817 45	491,981 34	277,836 12	1,860 83	3,260,495 74
Totals		$239,746,341 07	$56,613,290 82	$6,812,862 58	$3,269,250 34	$306,447,744 81

TABLE No. 54.

Showing the various items composing the Expenditures of Life Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Losses and Matured Endowments.	Surrendered Policies.	Dividends to Policy Holders.	Dividends to Stockholders.	Commissions.
Ætna Life	Hartford	$3,681,267 97	$356,004 82	$878,893 59	$175,000 00	$994,834 50
Connecticut Mutual Life	Hartford	4,816,995 10	549,445 96	1,305,439 28		390,479 67
Conservative Life	Los Angeles	6,000 00				3,612 80
Equitable Life	New York	16,907,613 01	4,907,821 66	3,481,640 65	7,000 00	4,909,291 09
Fidelity Mutual Life	Philadelphia	934,957 47	65,918 17	39,392 31		311,093 78
Germania Life	New York	1,907,648 68	374,928 43	213,928 11	24,000 00	370,305 81
Home Life	New York	660,832 37	136,410 83	177,799 82	15,000 00	289,056 99
Manhattan Life	New York	1,242,598 65	255,107 27	52,163 06	16,000 00	234,685 44
Massachusetts Mutual Life	Springfield	1,513,609 50	371,104 30	616,937 44		576,110 69
Mutual Life	New York	18,874,292 50	3,825,532 60	2,258,066 90		7,252,562 67
Mutual Benefit Life	Newark	5,005,019 80	1,222,775 58	1,720,341 31		1,014,524 88
National Life	Montpelier	988,626 38	407,933 03	152,422 19		581,677 78
New England Mutual Life	Boston	2,130,795 00	536,019 40	470,395 41		394,134 81
New York Life	New York	15,530,568 47	3,438,652 32	2,828,153 71		6,586,521 76
Northwestern Mutual Life	Milwaukee	5,448,598 63	1,164,433 91	3,229,330 47		2,548,329 67
Pacific Mutual Life	San Francisco	411,976 58	52,632 82	87,735 48	14,000 00	377,350 56
Penn Mutual Life	Philadelphia	2,805,388 19	691,181 64	907,050 50		1,103,203 73
Phœnix Mutual Life	Hartford	989,163 64	217,605 99	244,380 67		403,895 62
Provident Savings Life	New York	1,312,525 01	185,079 59	121,308 53	6,977 60	490,108 98
Security Trust and Life	Philadelphia	284,948 70	10,240 27			172,371 94
Travelers	Hartford	2,735,544 89	155,701 14		150,000 00	1,349,509 28
Union Central Life	Cincinnati	1,484,608 34	353,510 95	273,845 32	10,000 00	708,791 22
Union Mutual Life	Portland	747,063 37	103,822 96	54,943 47		265,513 86
Washington Life	New York	1,495,871 12	187,789 05	202,131 37	8,750 00	367,886 64
Totals		$91,916,513 37	$19,569,652 69	$19,316,299 59	$426,727 60	$31,695,854 17

TABLE No. 54—Continued.

Name.	Location.	Salaries.	Medical Examiners' Fees.	All Other Payments.	Total Expenditures.
Ætna Life	Hartford	$181,069 37	$77,389 45	$1,588,624 40	$7,933,084 10
Connecticut Mutual Life	Hartford	158,588 51	23,913 28	840,531 17	8,085,392 97
Conservative Life	Los Angeles	5,816 98	204 25	3,698 75	19,332 78
Equitable Life	New York	770,282 48	398,773 57	5,116,704 05	36,499,126 51
Fidelity Mutual Life	Philadelphia	125,888 83	52,568 88	333,653 78	1,863,473 22
Germania Life	New York	105,051 81	30,240 68	426,294 02	3,452,397 54
Home Life	New York	95,482 61	31,306 98	314,364 67	1,720,254 27
Manhattan Life	New York	100,399 58	39,965 25	364,175 87	2,305,095 12
Massachusetts Mutual Life	Springfield	131,378 22	46,907 00	428,148 13	3,684,195 28
Mutual Life	New York	709,529 90	559,868 86	5,966,760 08	39,446,613 51
Mutual Benefit Life	Newark	254,063 94	117,261 87	1,147,228 93	10,481,216 31
National Life	Montpelier	74,697 08	47,770 32	563,719 19	2,816,845 97
New England Mutual Life	Boston	140,518 58	25,583 19	407,363 82	4,104,810 21
New York Life	New York	735,954 31	617,967 64	5,811,750 83	35,549,569 04
Northwestern Mutual Life	Milwaukee	413,064 27	147,476 00	1,372,181 51	14,323,414 46
Pacific Mutual Life	San Francisco	57,230 66	40,382 29	762,877 21	1,804,185 60
Penn Mutual Life	Philadelphia	170,957 21	91,932 92	900,904 93	6,670,619 12
Phœnix Mutual Life	Hartford	78,431 63	52,692 00	275,293 20	2,261,462 75
Provident Savings Life	New York	185,731 74	86,992 22	492,202 89	2,880,926 56
Security Trust and Life	Philadelphia	34,524 43	15,879 46	267,542 57	785,507 37
Travelers	Hartford	200,055 06	91,010 89	866,631 93	5,548,453 19
Union Central Life	Cincinnati	120,638 53	55,511 00	570,615 88	3,577,521 24
Union Mutual Life	Portland	68,154 11	34,563 25	252,628 57	1,526,689 59
Washington Life	New York	115,723 13	67,389 84	489,506 26	2,935,047 41
Totals		$5,033,232 97	$2,753,551 09	$29,563,402 64	$200,275,234 12

TABLE No. 55.

Showing the Number and Amount of Policies, including additions, in force at the end of the previous year, and an Exhibit of the Policies Issued and of those which have ceased to be in force during the year, and those in force at the end of the year, of Life Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Policies in Force December 31, 1899.		Policies Issued and Revived During the Year.		Total.	
		Number.	Amount.	Number.	Amount.	Number.	Amount.
Ætna Life	Hartford	100,271	$168,449,790 00	20,463	$39,321,247 00	120,734	$207,771,037 00
Connecticut Mutual Life	Hartford	67,649	160,432,486 00	4,103	10,257,488 00	71,752	170,689,974 00
Conservative Life	Los Angeles			2,176	3,193,295 00	2,176	3,193,295 00
Equitable Life	New York	347,607	1,054,416,422 00	67,935	207,086,243 00	415,542	1,261,502,665 00
Fidelity Mutual Life	Philadelphia	35,226	77,182,941 00	9,775	21,175,379 00	45,001	98,358,320 00
Germania Life	New York	47,380	78,392,446 00	5,599	9,696,717 00	52,979	88,089,163 00
Home Life	New York	26,262	49,258,697 00	6,462	10,935,397 00	32,724	60,194,094 00
Manhattan Life	New York	26,434	57,989,519 00	4,630	11,157,991 00	31,064	69,147,510 00
Massachusetts Mutual Life	Springfield	51,730	123,980,438 00	10,175	22,878,308 00	61,905	146,858,746 00
Mutual Life	New York	397,340	1,051,247,540 00	75,881	176,006,030 00	473,221	1,227,253,570 00
Mutual Benefit Life	Newark	106,178	265,266,269 00	16,386	35,703,521 00	122,564	301,069,790 00
National Life	Montpelier	44,116	89,890,026 00	9,667	18,880,414 00	53,783	108,770,440 00
New England Mutual Life	Boston	42,850	114,531,763 00	6,801	15,502,807 00	49,651	130,034,570 00
New York Life	New York	437,776	1,061,871,985 00	116,332	234,783,625 00	554,108	1,296,655,610 00
Northwestern Mutual Life	Milwaukee	208,578	487,094,336 00	25,602	65,345,814 00	234,180	552,440,150 00
Pacific Mutual Life	San Francisco	10,960	21,255,954 00	6,121	10,222,966 00	17,081	31,478,920 00
Penn Mutual Life	Philadelphia	74,267	185,528,746 00	19,406	49,891,134 00	93,673	235,419,880 00
Phœnix Mutual Life	Hartford	35,512	57,988,162 00	9,332	15,737,182 00	44,844	73,725,344 00
Provident Savings Life	New York	32,689	107,040,100 00	11,839	39,210,425 00	44,528	146,250,525 00
Security Trust and Life	Philadelphia	5,755	12,628,318 00	4,906	9,905,688 00	10,661	22,534,006 00
Travelers	Hartford	39,311	100,334,554 00	8,494	20,292,340 00	47,805	120,626,894 00
Union Central Life	Cincinnati	74,068	136,157,485 00	16,517	33,089,471 00	90,585	169,246,956 00
Union Mutual Life	Portland	29,790	46,054,819 00	8,095	11,191,811 00	37,885	57,246,630 00
Washington Life	New York	28,534	57,398,572 00	7,106	17,466,939 00	35,640	74,865,511 00
Totals		2,270,283	$5,564,391,368 00	473,803	$1,089,032,232 00	2,744,086	$6,653,423,600 00

TABLE No. 56.

Showing the Number and Amount of Policies which have ceased to be in force during the year, with their mode of termination, of Life Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	By Death.		By Expiration and Maturity.		By Surrender.	
		Number.	Amount Insured.	Number.	Amount Insured.	Number.	Amount Insured.
Ætna Life	Hartford	1,484	$2,395,062 00	1,170	$1,898,112 00	1,083	$1,689,748 00
Connecticut Mutual Life	Hartford	1,655	4,256,267 00	237	456,712 00	630	1,494,267 00
Conservative Life	Los Angeles	7	8,500 00				
Equitable Life	New York	4,446	15,305,819 00	1,165	4,981,444 00	6,340	22,379,328 00
Fidelity Mutual Life	Philadelphia	396	1,001,898 00	126	243,000 00	145	324,081 00
Germania Life	New York	652	1,157,653 00	527	849,258 00	819	1,481,948 00
Home Life	New York	277	517,733 00	93	146,098 00	529	1,092,593 00
Manhattan Life	New York	427	1,105,544 00	61	168,607 00	397	864,869 00
Massachusetts Mutual Life	Springfield	493	1,365,288 00	117	245,720 00	1,113	2,269,322 00
Mutual Life	New York	4,904	15,271,852 00	1,378	4,614,706 00	2,837	6,465,105 00
Mutual Benefit Life	Newark	1,457	4,213,444 00	1,542	3,744,957 00	2,962	7,073,818 00
National Life	Montpelier	363	858,659 00	146	310,804 00	1,258	2,416,663 00
New England Mutual Life	Boston	541	1,672,303 00	188	566,575 00	888	2,092,244 00
New York Life	New York	4,677	12,735,114 00	17,902	33,147,051 00	4,580	13,622,857 00
Northwestern Mutual Life	Milwaukee	1,845	4,700,636 00	514	2,851,325 00	2,108	3,513,957 00
Pacific Mutual Life	San Francisco	111	282,750 00	36	79,800 00	165	362,705 00
Penn Mutual Life	Philadelphia	757	2,081,925 00	520	1,259,133 00	1,229	2,885,517 00
Phœnix Mutual Life	Hartford	552	881,517 00	168	254,464 00	498	879,340 00
Provident Savings Life	New York	396	1,344,804 00	5,893	23,813,529 00	104	358,678 00
Security Trust and Life	Philadelphia	105	306,617 00	2	3,500 00	100	294,072 00
Travelers	Hartford	507	1,413,887 00	446	1,097,302 00	384	896,101 00
Union Central Life	Cincinnati	562	985,271 00	534	889,915 00	455	1,148,992 00
Union Mutual Life	Portland	332	600,451 54	562	948,420 00	450	816,372 00
Washington Life	New York	409	958,772 00	294	619,022 00	463	977,165 00
Totals		27,355	$75,421,766 00	33,621	$83,189,454 00	29,537	$75,399,742 00

TABLE No. 56—Continued.

Name.	Location.	By Lapse.		By Change and Decrease, and Not Taken.	
		Number.	Amount Insured.	Number.	Amount Insured.
Ætna Life	Hartford	2,160	$4,513,436 00	2,377	$4,881,863 00
Connecticut Mutual Life	Hartford	842	1,850,763 00	227	1,065,362 00
Conservative Life	Los Angeles	334	465,250 00	5	5,000 00
Equitable Life	New York	18,606	55,180,672 00	11,308	46,780,355 00
Fidelity Mutual Life	Philadelphia	4,572	9,698,210 00	1,969	4,971,946 00
Germania Life	New York	1,844	2,985,536 00	---------	180,359 00
Home Life	New York	1,671	2,625,723 00	951	1,742,094 00
Manhattan Life	New York	1,373	3,424,559 00	1,203	3,322,780 00
Massachusetts Mutual Life	Springfield	1,880	3,415,907 00	978	3,323,586 00
Mutual Life	New York	24,627	60,892,223 00	35	69,155 00
Mutual Benefit Life	Newark	2,087	3,803,205 00	1,947	4,062,930 00
National Life	Montpelier	1,819	3,274,797 00	1,080	2,437,678 00
New England Mutual Life	Boston	1,081	2,191,981 00	1,179	3,000,751 00
New York Life	New York	15,349	28,909,003 00	---------	6,084,920 00
Northwestern Mutual Life	Milwaukee	4,876	9,609,483 00	90	2,117,459 00
Pacific Mutual Life	San Francisco	1,378	2,017,690 00	894	1,584,363 00
Penn Mutual Life	Philadelphia	3,953	8,771,758 00	2,845	10,020,801 00
Phœnix Mutual Life	Hartford	2,286	3,644,690 00	2,331	4,263,194 00
Provident Savings Life	New York	1,346	4,930,169 00	4,078	12,927,217 00
Security Trust and Life	Philadelphia	990	1,969,643 00	3,065	6,582,715 00
Travelers	Hartford	1,624	3,308,177 00	1,698	4,891,576 00
Union Central Life	Cincinnati	5,097	9,246,071 00	3,020	8,140,185 00
Union Mutual Life	Portland	2,248	3,076,508 00	1,117	1,948,600 00
Washington Life	New York	3,057	7,677,452 00	1,238	3,549,411 00
Totals		105,100	$237,482,906 00	43,635	$137,954,300 00

TABLE NO. 57.

Summary of Assets, Liabilities, Incomes, Expenditures, etc., of Miscellaneous Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Capital Paid Up.	Assets.	Liabilities.	Income.	Expenditures.	Losses Incurred during the Year.	Net Surplus.
Ætna Indemnity	Hartford	$250,000 00	$331,205 31	$72,324 62	$132,190 14	$117,084 28	$47,055 16	$8,880 69
American Bonding and Trust	Baltimore	1,000,000 00	1,641,065 67	238,355 02	469,070 72	410,283 95	83,699 70	402,710 65
American Credit Indemnity	New York	200,000 00	580,266 98	258,044 32	467,121 07	313,164 47	75,352 13	122,222 66
American Surety	New York	2,500,000 00	5,217,513 48	883,867 84	1,355,070 08	1,280,739 68	882,600 00	1,833,645 64
California Title Insurance and Trust	San Francisco	250,000 00	357,116 12	45,000 00	81,668 83	40,858 69	301 42	62,116 12
City Trust, Safe Deposit, and Surety	Philadelphia	500,000 00	3,348,355 32	2,588,081 76	343,694 52	312,586 64	87,322 72	260,273 56
Employers Liability	London	------------	1,551,383 60	992,673 97	1,430,892 43	1,211,877 39	744,211 98	558,709 63
Fidelity and Casualty	New York	250,000 00	3,936,215 60	2,793,219 47	3,746,257 69	3,430,304 27	1,367,828 44	892,996 13
Fidelity and Deposit	Baltimore	1,500,000 00	4,381,313 79	805,409 48	1,386,130 75	1,222,514 29	305,471 97	2,075,904 31
Frankfort-American	New York	300,000 00	488,651 22	179,077 50	254,567 51	207,013 74	89,075 92	9,573 72
Hartford Steam Boiler	Hartford	500,000 00	2,701,027 06	1,579,286 21	1,288,276 05	1,122,851 06	92,887 56	621,740 85
Lloyds Plate Glass	New York	250,000 00	651,165 19	265,138 55	457,077 65	474,355 62	221,601 61	136,026 64
London Guarantee & Accident	London	------------	1,171,519 90	741,228 04	944,165 61	820,170 64	410,666 32	430,291 86
Maryland Casualty	Baltimore	750,000 00	2,326,095 53	898,113 18	1,581,220 05	1,364,569 80	450,050 35	677,982 35
Metropolitan Plate Glass	New York	100,000 00	466,876 25	153,457 54	295,220 65	319,089 24	140,899 05	213,418 71
National Surety	New York	500,000 00	1,508,541 65	416,217 03	657,540 35	522,560 75	104,108 59	592,324 62
New York Plate Glass	New York	100,000 00	396,516 25	138,440 80	260,428 78	275,181 81	128,581 94	158,075 45
North American Accident	Chicago	100,000 00	212,765 75	74,696 39	134,487 26	113,693 70	40,329 90	38,069 36
Ocean Accident and Guarantee	London	------------	1,439,212 29	313,616 26	513,756 53	273,487 21	124,973 58	1,125,596 03
Pacific Surety	San Francisco	250,000 00	325,374 02	33,707 65	68,849 40	53,773 77	8,488 96	41,666 37
Preferred Accident	New York	200,000 00	899,231 61	510,790 13	1,108,199 53	971,373 94	385,311 45	188,441 48
Standard Life and Accident	Detroit	250,000 00	1,155,222 63	699,861 11	1,278,015 29	1,071,714 63	574,379 45	205,361 52
Title Insurance and Trust	Los Angeles	400,000 00	470,483 91	8,942 71	85,763 31	81,787 40	529 99	61,541 20
Union Casualty and Surety	St. Louis	250,000 00	477,011 52	134,797 80	471,830 65	419,158 20	225,911 35	92,213 72
United States Fidelity and Guaranty	Baltimore	1,500,000 00	2,256,197 83	491,629 94	869,451 09	783,664 57	218,711 43	264,567 89
Totals		$11,900,000 00	$38,290,328 48	$15,315,977 32	$19,680,945 94	$17,213,859 74	$6,810,350 97	$11,074,351 16

TABLE No. 58.

Showing the various items composing the Assets of Miscellaneous Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Real Estate.	Mortgage Loans.	Stocks and Bonds Owned.	Collateral Loans.	Cash in Office and Banks.
Ætna Indemnity	Hartford			$301,007 50		$17,576 55
American Bonding and Trust	Baltimore	$23,464 44	$150,561 86	940,210 25	$271,785 61	84,105 39
American Credit Indemnity	New York			324,050 00		56,348 06
American Surety	New York	3,011,089 29	18,583 76	1,156,437 50	644,211 57	263,930 37
California Title Insurance and Trust	San Francisco	52,137 87	106,426 24	25,010 00		23,404 26
City Trust, Safe Deposit, and Surety	Philadelphia	657,100 00	69,700 00	437,790 50	1,329,597 24	669,899 90
Employers Liability	London			1,281,853 75		34,678 91
Fidelity and Casualty	New York	567,737 29		2,880,483 25		119,314 30
Fidelity and Deposit	Baltimore	600,000 00		3,364,357 00		319,584 71
Frankfort-American	New York			397,024 39		49,371 28
Hartford Steam Boiler	Hartford	30,712 00	458,450 00	1,821,365 00		150,068 37
Lloyds Plate Glass	New York	265,000 00		319,285 95		21,328 10
London Guarantee and Accident	London			1,011,703 40		50,899 09
Maryland Casualty	Baltimore			1,244,522 45	603,850 00	117,337 63
Metropolitan Plate Glass	New York	150,000 00		258,435 00		22,554 82
National Surety	New York	11,225 00	13,704 39	1,256,050 00	32,000 00	67,967 70
New York Plate Glass	New York		2,500 00	337,685 00		25,509 77
North American Accident	Chicago		83,050 00	35,101 39	14,000 00	23,854 41
Ocean Accident and Guarantee	London			1,358,832 50		30,370 39
Pacific Surety	San Francisco	4,000 00	166,111 03	82,890 55		63,036 41
Preferred Accident	New York			637,145 00		170,748 46
Standard Life and Accident	Detroit	87,930 43	255,687 00	522,031 00		96,702 47
Title Insurance and Trust	Los Angeles	96,732 14	100,454 93	16,487 10	7,448 45	13,186 22
Union Casualty and Surety	St. Louis		89,985 00	260,000 00		41,441 08
United States Fidelity and Guaranty	Baltimore	138,467 04	300 00	876,541 75	790,789 00	184,566 11
Totals		$5,695,595 50	$1,515,514 21	$21,146,300 23	$3,693,681 87	$2,717,784 76

TABLE No. 58—Continued.

Name.	Location.	Interest Due and Accrued.	Premiums in Course of Collection.	All Other Assets.	Total Assets.
Ætna Indemnity	Hartford	$3,664 59	$7,742 42	$1,214 25	$331,205 31
American Bonding and Trust	Baltimore	17,640 58	6,141 52	147,156 02	1,641,065 67
American Credit Indemnity	New York	500 00	38,185 00	161,183 92	580,266 98
American Surety	New York	30,179 39	93,081 60		5,217,513 48
California Title Insurance and Trust	San Francisco	20,146 75	4,991 00	125,000 00	357,116 12
City Trust, Safe Deposit, and Surety	Philadelphia	23,943 00	9,330 35	150,994 33	3,348,355 32
Employers Liability	London	10,134 58	224,716 36		1,551,383 60
Fidelity and Casualty	New York	3,739 71	341,156 43	23,784 62	3,936,215 60
Fidelity and Deposit	Baltimore		97,372 08		4,381,313 79
Frankfort-American	New York	4,923 33	37,332 22		488,651 22
Hartford Steam Boiler	Hartford	12,616 93	223,391 28	4,423 48	2,701,027 06
Lloyds Plate Glass	New York		45,551 14		651,165 19
London Guarantee and Accident	London	9,724 08	99,193 33		1,171,519 90
Maryland Casualty	Baltimore	4,430 00	255,955 45	100,000 00	2,326,095 53
Metropolitan Plate Glass	New York	482 92	30,803 05	4,600 46	466,876 25
National Surety	New York	8,416 72	43,923 75	75,254 09	1,508,541 65
New York Plate Glass	New York		30,821 48		396,516 25
North American Accident	Chicago	2,013 99	50,506 17	4,239 79	212,765 75
Ocean Accident and Guarantee	London	8,217 50	41,791 90		1,439,212 29
Pacific Surety	San Francisco	2,651 94	6,684 09		325,374 02
Preferred Accident	New York	2,788 15	88,550 00		899,231 61
Standard Life and Accident	Detroit	12,049 10	180,822 63		1,155,222 63
Title Insurance and Trust	Los Angeles	1,175 07		235,000 00	470,483 91
Union Casualty and Surety	St. Louis	2,300 95	72,379 01	10,905 48	477,011 52
United States Fidelity and Guaranty	Baltimore	16,445 36	172,755 86	76,332 71	2,256,197 83
Totals		$198,184 64	$2,203,178 12	$1,120,089 15	$38,290,328 48

TABLE NO. 59.

Showing the various items composing the Liabilities, except Capital Stock, of Miscellaneous Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Losses Unadjusted.	Losses Resisted.	Cash Dividends Remaining Unpaid.	Unearned Premiums.	All Other Claims.	Total Liabilities.	Net Surplus.
Ætna Indemnity	Hartford	$9,065 75			$61,054 37	$2,204 50	$72,324 62	$8,880 69
American Bonding and Trust	Baltimore	24,803 47			210,408 30	3,143 25	238,355 02	403,676 65
American Credit Indemnity	New York	13,981 43	$5,551 00		238,511 89		258,044 32	122,222 66
American Surety	New York	95,237 68	196,378 49		592,251 67		883,867 84	1,833,645 64
California Title Insurance and Trust	San Francisco					45,000 00	45,000 00	62,116 12
City Trust, Safe Deposit, and Surety	Philadelphia	3,821 16	58,704 74		129,824 89	2,395,730 97	2,588,081 76	260,273 56
Employers Liability	London	56,340 00	280,500 00		644,565 51	11,268 46	992,673 97	558,709 63
Fidelity and Casualty	New York	214,335 78	526,754 82		1,859,134 49	193,004 38	2,793,219 47	892,996 13
Fidelity and Deposit	Baltimore	49,607 70	105,553 39		650,248 39		805,409 48	2,075,904 31
Frankfort-American	New York	15,170 74	36,300 00		127,606 76		179,077 50	9,573 72
Hartford Steam Boiler	Hartford	17,851 85			1,561,434 36		1,579,286 21	621,740 85
Lloyds Plate Glass	New York	3,399 74			232,967 02	28,771 79	265,138 55	136,026 64
London Guarantee & Accident	London	49,839 80	246,340 00		385,047 78	60,000 46	741,228 04	430,291 86
Maryland Casualty	Baltimore	71,798 44	127,559 50	$29 75	673,725 49	25,000 00	898,113 18	677,982 35
Metropolitan Plate Glass	New York	5,543 96			142,839 24	5,074 34	153,457 54	213,418 71
National Surety	New York	25,504 55	18,037 59		263,987 48	108,687 41	416,217 03	592,324 62
New York Plate Glass	New York	3,253 58		5,000 00	128,090 93	2,096 29	138,440 80	158,075 45
North American Accident	Chicago	8,182 22			63,293 34	3,220 83	74,696 39	38,069 36
Ocean Accident and Guarantee	London	5,806 00	48,240 88		259,569 38		313,616 26	1,125,596 03
Pacific Surety	San Francisco	2,500 00	1,700 00		29,507 65		33,707 65	41,666 37
Preferred Accident	New York	61,000 00	17,000 00		430,066 78	2,723 35	510,790 13	188,441 48
Standard Life and Accident	Detroit	68,085 00	112,440 00		506,484 75	12,851 36	699,861 11	205,361 52
Title Insurance and Trust	Los Angeles					8,942 71	8,942 71	60,691 13
Union Casualty and Surety	St. Louis	8,970 92	32,600 00		92,041 88	1,185 00	134,797 80	92,213 72
United States Fidelity and Guaranty	Baltimore	20,120 48	10,150 86		461,358 60		491,629 94	264,567 89
Totals		$834,210 25	$1,823,811 27	$5,029 75	$9,744,020 95	$2,908,905 10	$15,315,977 32	$11,074,467 09

TABLE No. 60.

Showing the various items composing the Incomes of Miscellaneous Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Premiums.	Interest.	Rents.	All Other Sources.	Total Income.
Ætna Indemnity	Hartford	$120,174 71	$9,922 48	--------	$2,092 95	$132,190 14
American Bonding and Trust	Baltimore	381,510 19	55,638 17	--------	31,922 36	469,070 72
American Credit Indemnity	New York	453,420 41	11,227 09	--------	2,473 57	467,121 07
American Surety	New York	986,966 39	79,027 42	$185,657 42	103,418 85	1,355,070 08
California Title Insurance and Trust	San Francisco	60,306 25	5,407 33	2,048 40	13,906 85	81,668 83
City Trust, Safe Deposit, and Surety	Philadelphia	222,607 38	99,606 45	13,593 45	7,887 24	343,694 52
Employers Liability	London	1,393,647 35	37,245 08	--------	--------	1,430,892 43
Fidelity and Casualty	New York	3,572,502 36	97,978 65	63,471 68	12,305 00	3,746,257 69
Fidelity and Deposit	Baltimore	1,138,262 47	135,671 43	38,453 32	73,743 53	1,386,130 75
Frankfort-American	New York	228,799 95	9,900 00	--------	15,867 56	254,567 51
Hartford Steam Boiler	Hartford	1,148,040 14	110,041 82	5,857 34	24,336 75	1,288,276 05
Lloyds Plate Glass	New York	426,814 39	12,597 73	11,759 35	5,906 18	457,077 65
London Guarantee and Accident	London	911,052 00	33,113 61	--------	--------	944,165 61
Maryland Casualty	Baltimore	1,447,419 04	76,880 87	--------	56,920 14	1,581,220 05
Metropolitan Plate Glass	New York	283,030 88	10,313 13	1,876 64	--------	295,220 65
National Surety	New York	558,746 78	40,588 33	--------	58,205 24	657,540 35
New York Plate Glass	New York	248,079 29	12,193 14	--------	156 35	260,428 78
North American Accident	Chicago	129,190 61	5,296 65	--------	--------	134,487 26
Ocean Accident and Guarantee	London	470,140 19	40,335 09	--------	3,281 25	513,756 53
Pacific Surety	San Francisco	50,644 87	17,713 00	--------	491 53	68,849 40
Preferred Accident	New York	1,087,558 03	20,641 50	--------	--------	1,108,199 53
Standard Life and Accident	Detroit	1,178,667 36	32,456 29	1,891 64	65,000 00	1,278,015 29
Title Insurance and Trust	Los Angeles	4,491 50	6,117 28	600 00	74,554 53	85,763 31
Union Casualty and Surety	St. Louis	355,705 20	16,105 45	--------	100,020 00	471,830 65
United States Fidelity and Guaranty	Baltimore	776,808 92	57,791 63	4,306 34	30,544 20	869,451 09
Totals	--------	$17,634,586 66	$1,033,809 62	$329,515 58	$683,034 08	$19,680,945 94

TABLE No. 61.

Showing the various items composing the Expenditures of Miscellaneous Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Losses.	Dividends.	Brokerage and Commission.	Office Salaries	Taxes.	All Other Expenditures.	Total Expenditures.
Ætna Indemnity	Hartford	$39,736 82	----------	$28,647 75	$12,492 69	$2,920 52	$33,286 50	$117,084 28
American Bonding and Trust	Baltimore	83,699 70	$60,000 00	80,560 90	45,034 61	33,947 18	107,041 56	410,283 95
American Credit Indemnity	New York	75,352 13	18,000 00	128,023 14	35,202 33	11,552 94	45,033 93	313,164 47
American Surety	New York	385,285 05	200,000 00	55,165 35	180,363 19	78,115 39	381,810 70	1,280,739 68
California Title Insurance and Trust	San Francisco	301 42	----------	1,629 50	21,486 15	1,169 67	16,271 95	40,858 69
City Trust, Safe Deposit, and Surety	Philadelphia	42,581 21	30,030 00	19,236 78	61,721 51	16,730 78	142,286 36	312,586 64
Employers Liability	London	587,166 08	----------	333,126 44	33,343 23	40,486 83	217,754 81	1,211,877 39
Fidelity and Casualty	New York	1,612,828 34	50,000 00	937,771 81	248,724 86	96,328 08	484,651 18	3,430,304 27
Fidelity and Deposit	Baltimore	371,259 86	262,447 50	279,261 34	77,835 04	52,319 11	179,391 44	1,222,514 29
Frankfort-American	New York	89,075 92	----------	53,545 76	5,420 00	4,452 40	54,519 66	207,013 74
Hartford Steam Boiler	Hartford	109,331 53	80,000 00	276,519 37	51,200 50	30,061 16	575,738 50	1,122,851 06
Lloyds Plate Glass	New York	221,180 59	25,000 00	135,401 88	51,628 42	16,050 96	25,093 77	474,355 62
London Guarantee & Accident	London	410,666 32	----------	244,959 31	40,125 06	24,811 98	99,607 97	820,170 64
Maryland Casualty	Baltimore	450,030 55	89,970 25	459,951 42	23,051 67	44,469 70	297,096 21	1,364,569 80
Metropolitan Plate Glass	New York	137,355 09	20,000 00	97,145 84	32,785 00	12,717 46	19,085 85	319,089 24
National Surety	New York	95,129 61	50,000 00	43,918 32	98,309 42	17,791 90	217,411 50	522,560 75
New York Plate Glass	New York	129,341 09	10,000 00	78,583 89	26,743 80	9,217 92	21,295 11	275,181 81
North American Accident	Chicago	39,972 68	----------	36,112 71	15,520 57	1,927 95	20,159 79	113,693 70
Ocean Accident and Guarantee	London	69,302 33	----------	104,812 36	32,737 84	7,654 60	58,980 08	273,487 21
Pacific Surety	San Francisco	3,929 81	15,000 00	5,701 37	13,437 25	3,759 41	11,945 93	53,773 77
Preferred Accident	New York	348,386 45	12,000 00	347,153 02	75,785 50	18,809 70	169,239 27	971,373 94
Standard Life and Accident	Detroit	528,787 78	10,000 00	323,574 50	52,642 54	33,758 74	122,951 07	1,071,714 63
Title Insurance and Trust	Los Angeles	936 41	17,000 00	----------	45,531 85	779 25	17,539 89	81,787 40
Union Casualty and Surety	St. Louis	225,911 35	----------	101,438 84	28,570 28	11,589 87	51,647 86	419,158 20
United States Fidelity and Guaranty	Baltimore	188,440 09	75,000 00	177,459 09	68,246 82	47,632 25	226,886 32	783,664 57
Totals	----------	$6,245,988 21	$1,024,447 75	$4,349,700 69	$1,377,940 13	$619,055 75	$3,596,727 21	$17,213,859 74

TABLE No. 62.

Showing the various items composing the Assets of Assessment Life Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Mortgage Loans.	Stocks and Bonds.	Cash in Office and Banks.	Deposited for Protection of Policy Holders.
Bankers Life Association	Des Moines	$2,969,063 39	$296,563 35	$135,246 89	
Decimal Mutual Life	San Francisco			324 50	$10,000 00
Fidelity Mutual Aid	San Francisco	283 70	1,122 50	13,396 98	6,000 00
Totals		$2,969,347 09	$297,685 85	$148,968 37	$16,000 00

Name.	Location.	Guarantee Fund Notes.	Interest Due and Accrued.	All Other Assets.	Total Assets.
Bankers Life Association	Des Moines	$625,205 05	$71,395 59	$88,666 00	$4,186,140 27
Decimal Mutual Life	San Francisco				10,324 50
Fidelity Mutual Aid	San Francisco			1,496 25	22,299 43
Totals		$625,205 05	$71,395 59	$90,496 25	$4,218,764 20

TABLE No. 63.

Showing the various items composing the Liabilities of Assessment Life Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Losses Unpaid.	Taxes Due and Accrued.	Advance Assessments.	All Other Liabilities.	Total Liabilities.
Bankers Life Association	Des Moines	$88,666 00	$3,551 22	$1,404 85		$93,622 07
Decimal Mutual Life	San Francisco				$12,499 35	12,499 35
Fidelity Mutual Aid	San Francisco	1,493 30			107 42	1,600 72
Totals		$90,159 30	$3,551 22	$1,404 85	$12,606 77	$107,722 14

TABLE NO. 64.

Showing the various items composing the Incomes of Assessment Life Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Membership Fees.	Annual Dues.	Assessments.	Interest and Rent.	All Other Sources.	Total Income.
Bankers Life Association	Des Moines	$56,800 48		$1,046,393 20	$179,010 00	$305,402 65	$1,587,606 33
Decimal Mutual Life	San Francisco		$354 50		720 15	77 05	1,151 70
Fidelity Mutual Aid	San Francisco	2,398 80	61,226 13		327 70		63,952 63
Totals		$59,199 28	$61,580 63	$1,046,393 20	$180,057 85	$305,479 70	$1,652,710 66

TABLE NO. 65.

Showing the various items composing the Expenditures of Assessment Life Insurance Companies doing business in California on December 31, 1900.

Name.	Location.	Losses and Claims.	Commissions.	Commissions for Collecting Assessments.	Salaries of Managers and Agents.	Office Salaries.
Bankers Life Association	Des Moines	$878,991 32	$54,913 26	$29,261 82	$4,237 95	$47,288 18
Decimal Mutual Life	San Francisco					87 05
Fidelity Mutual Aid	San Francisco	24,323 77	6,095 35	1,095 02	8,925 00	8,226 10
Totals		$903,315 09	$61,008 61	$30,356 84	$13,162 95	$55,601 33

Name.	Location.	Medical Examiners' Fees.	Rents, Taxes, etc.	All Other Disbursements.	Total Disbursements.
Bankers Life Association	Des Moines	$25,507 00	$27,009 42	$54,814 38	$1,122,023 33
Decimal Mutual Life	San Francisco			740 15	827 20
Fidelity Mutual Aid	San Francisco		3,316 23	11,583 34	63,564 81
Totals		$25,507 00	$30,325 65	$67,137 87	$1,186,415 34

TABLE NO. 66.

Showing Risks Written and Risks Terminated during the year ending December 31, 1900, of Assessment Life Insurance Companies doing business in California.

Name.	Location.	In Force December 31, 1899.		Certificates Written.	
		Number.	Amount.	Number.	Amount.
Bankers Life Association	Des Moines	64,683	$129,366,000 00	10,063	$20,126,000 00
Decimal Mutual Life	San Francisco	21	21,000 00	1	1,000 00
Fidelity Mutual Aid	San Francisco	3,927	4,321,900 00	6,594	7,002,500 00
Totals		68,631	$133,708,900 00	16,658	$27,129,500 00

Name.	Location.	Certificates Terminated.		In Force December 31, 1900.	
		Number.	Amount.	Number.	Amount.
Bankers Life Association	Des Moines	3,118	$6,236,000 00	71,628	$143,256,000 00
Decimal Mutual Life	San Francisco			22	22,000 00
Fidelity Mutual Aid	San Francisco	6,570	7,071,400 00	3,951	4,253,000 00
Totals		9,688	$13,307,400 00	75,601	$147,531,000 00

TABLE NO. 67.

Statement of Office Collections, showing amounts collected from the different Companies for the year ending December 31, 1900, for filing and certifying copies of papers, taxes, and substitution of securities.

Name.	Amount.
Fireman's Fund	$20 00
Home Fire and Marine	20 00
Occidental	35 00
Pacific Mutual Life	55 00
Pacific Surety	40 00
Conservative Life	35 00
Humboldt County Fire	1 00
Los Angeles County Mutual Fire	1 00
Mutual Fire	1 00
Orange County Farmers Mutual Fire	1 00
San Bernardino County Mutual Fire	----------
Santa Clara County Fire	5 00
Scandinavian Mutual Protective Fire	1 00
Sonoma County Farmers Mutual Fire	1 00
Ventura County Mutual Fire	1 00
Ætna	20 00
Agricultural	305 70
American	705 17
American	262 94
American Central	687 97
American Fire	1,263 81
American Fire	131 42
Assurance Company of America	60 01
Boston	273 84
Caledonian American	65 80
Commercial Union Fire	67 54
Continental	1,657 12
Delaware	65 00
Equitable Fire and Marine	20 00
Fidelity Fire	152 50
Fire Association	805 42
Franklin Fire	1,282 03
German	65 00
German Alliance	280 19
German-American	1,237 32
Germania Fire	65 00
Girard Fire and Marine	223 81
Glens Falls	65 00
Greenwich	471 36
Hanover Fire	748 44
Hartford Fire	20 00
Home	3,109 18
Insurance Company of North America	2,618 89
Insurance Company of the State of Pennsylvania	347 74
Kings County Fire	53 17
Manhattan Fire	75 00
Magdeburg Fire	102 45
Mercantile Fire and Marine	202 00
Merchants	980 77
Milwaukee Mechanics	1,838 74
National Standard	47 47
New Hampshire Fire	65 00
Niagara Fire	576 25
North German Fire	96 28
Northwestern National	1,572 94
Norwalk Fire	20 00
Orient	30 00
Amount carried forward	$22,955 27
Amount brought forward	$22,955 27
Pelican	87 11
Pennsylvania Fire	2,101 19
Phenix	251 37
Phœnix	20 00
Providence-Washington	20 00
Queen	921 28
Springfield Fire and Marine	1,037 00
St. Paul Fire and Marine	1,103 56
Teutonia	445 21
Thuringia American Fire	343 07
Traders	158 04
Union	380 84
United States Fire	183 40
Victoria Fire	110 07
Westchester Fire	1,040 41
Williamsburg City Fire	566 97
National Fire	20 00
Aachen and Munich Fire	20 00
Alliance	20 00
Atlas	20 00
Baloise Fire	20 00
British-America	20 00
Caledonian	30 00
Commercial Union	20 00
Hamburg-Bremen Fire	20 00
Helvetia Swiss Fire	20 00
Imperial	20 00
Lancashire	20 00
Law, Union, and Crown	20 00
Lion Fire	20 00
Liverpool and London and Globe	20 00
London	20 00
London and Lancashire	20 00
Magdeburg Fire	20 00
Manchester Fire	30 00
Netherlands Fire	65 00
New Zealand	20 00
North British and Mercantile	20 00
Northern	20 00
North German Fire	20 00
Norwich Union Fire	20 00
Palatine	20 00
Phœnix	20 00
Prussian National	30 00
Royal	20 00
Royal Exchange	20 00
Scottish Union and National	20 00
State Fire	20 00
Sun	20 00
Svea	20 00
Thuringia	20 00
Transatlantic Fire	20 00
Union	20 00
Western	20 00
Alliance	20 00
Alliance Marine	20 00
American and Foreign Marine	20 00
Baloise	20 00
British and Foreign Marine	20 00
Canton	20 00
China Traders	20 00
Amount carried forward	$32,699 79

TABLE No. 67—Continued.

Name.	Amount.
Amount brought forward	$32,699 79
Fonciere	20 00
Frankfort Marine	21 00
Helvetia General	20 00
Imperial Marine	20 00
Indemnity Mutual Marine	20 00
London and Provincial Marine	20 00
Mannheim	30 00
Man On	20 00
Marine	20 00
Munich	20 00
Nippon Marine	65 00
Nippon Sea and Land	20 00
North China	20 00
Ocean Marine	20 00
Po On	20 00
Reliance Marine	20 00
Sea	20 00
Standard Marine	20 00
Switzerland Marine	20 00
Thames and Mersey	20 00
Union Marine	20 00
Universo Marine	20 00
Wilhelma	120 00
Yangtse	20 00
Maritime	20 00
Ætna Life	20 00
Connecticut Mutual Life	20 00
Equitable Life	20 00
Germania Life	20 00
Home Life	20 00
Manhattan Life	20 00
Massachusetts Mutual Life	20 00
Mutual Life	20 00
Mutual Benefit Life	20 00
National Life	20 00
New England Mutual Life	20 00
New York Life	28 90
Northwestern Mutual Life	20 00
Penn Mutual Life	4,264 04
Phœnix Mutual Life	30 00
Provident Savings Life	20 00
Security Trust and Life	
Amount carried forward	$37,938 73
Amount brought forward	$37,938 73
Travelers	20 00
Union Central Life	1,121 04
Union Mutual Life	888 41
Washington Life	20 00
Fidelity Mutual Life	30 00
Employers Liability	20 00
Fidelity and Casualty	20 00
Frankfort-American	20 00
London Guarantee and Accident	24 00
Maryland Casualty	211 18
New Amsterdam Casualty	20 00
North American Accident	65 00
Preferred Accident	20 00
Standard Life and Accident	1,292 45
American Bonding and Trust	365 00
American Surety	30 00
City Trust, Safe Deposit, and Surety	20 00
Fidelity and Deposit	1,396 56
National Surety	20 00
United States Fidelity and Guaranty	447 26
Lloyds Plate Glass	20 00
Metropolitan Plate Glass	20 00
New York Plate Glass	20 00
Hartford Steam Boiler	20 00
California Title Insurance and Trust	20 00
Title Insurance and Trust	20 00
American Credit Indemnity	30 00
Ocean Accident and Guarantee	30 00
Union Casualty and Surety	10 00
Bankers Life Association	31 00
Fidelity Mutual Aid	20 00
Ministerial Life	20 00
Mutual Reserve Fund	20 00
Northwestern Life Association	40 00
Pacific States Life	20 00
Decimal Mutual Life	20 00
Mutual Indemnity	20 00
Total	$44,370 63

I certify the foregoing to be a full, true, and correct statement of the receipts of the Insurance Department of the State of California for the year nineteen hundred.

M. M. RHORER,
Deputy Insurance Commissioner.

Subscribed and sworn to before me this 8th day of July, 1901.

[NOTARIAL SEAL.]

JAMES L. KING,
Notary Public in and for the City and County
of San Francisco, State of California.

UNIVERSITY OF CALIFORNIA PUBLICATIONS.

UNIVERSITY OF CALIFORNIA—COLLEGE OF AGRICULTURE.

AGRICULTURAL EXPERIMENT STATION.

REPORT OF WORK
OF THE
AGRICULTURAL EXPERIMENT STATION
OF THE
UNIVERSITY OF CALIFORNIA

FOR THE YEARS 1898-1901.

PART I.

BEING A PART OF THE REPORT OF THE REGENTS OF THE UNIVERSITY.

SACRAMENTO:
A. J. JOHNSTON, : : : : : SUPERINTENDENT STATE PRINTING.
1902.

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BENJAMIN IDE WHEELER, Ph.D., LL.D., *President of the University.*

EXPERIMENT STATION STAFF.

E. W. HILGARD, Ph.D., LL.D., *Director and Chemist.*
E. J. WICKSON, M.A., *Horticulturist.*
W. A. SETCHELL, Ph.D., *Botanist.*
R. H. LOUGHRIDGE, Ph.D., *Agricultural Geologist and Soil Physicist.* (*Soils and Alkali.*)
C. W. WOODWORTH, M.S., *Entomologist.*
M. E. JAFFA, M.S., *Assistant Chemist.* (*Foods, Fertilizers.*)
G. W. SHAW, M.A., Ph.D., *Assistant Chemist.* (*Soils, Beet-Sugar.*)
GEORGE E. COLBY, M.S., *Assistant Chemist.* (*Fruits, Waters, Insecticides.*)
LEROY ANDERSON, M.S.A., *Dairy Husbandry.*
A. R. WARD, B.S.A., D.V.M., *Veterinarian, Bacteriologist.*
E. H. TWIGHT, B.Sc., Diplomé E.A.M., *Viticulturist.*
J. BURTT DAVY, *Assistant Botanist.*
CARROL FOWLER, B.S., *Acting Entomologist 1900–1901.*
W. T. CLARKE, *Assistant Entomologist.*
C. H. SHINN, B.A., *Inspector of Stations.*
C. A. COLMORE, B.S., *Clerk to the Director.*

EMIL KELLNER, *Foreman of Central Station Grounds.*

JOHN TUOHY, *Patron,* JULIUS FORRER, *Foreman,*	Tulare Substation, Tulare.	
R. C. RUST, *Patron,* JOHN H. BARBER, *Foreman,*	Foothill Substation, Jackson.	
S. D. MERK, *Patron,* J. H. OOLEY, *Workman in charge,*	Coast Range Substation, Paso Robles.	
S. N. ANDROUS, *Patron,* J. W. MILLS, *Foreman,*	Southern California Substation,	Pomona. Ontario.
V. C. RICHARDS, *Patron,* T. L. BOHLENDER, *in charge,*	Forestry Station, Chico.	
ROY JONES, *Patron,* WM. SHUTT, *Foreman,*	Forestry Station, Santa Monica.	

FINANCIAL STATEMENTS, 1898-1901.

The Agricultural Experiment Station of the University of California, in Account with the United States Appropriation, 1898-99.

		Cr. 1898-99.	Dr. 1898-99.
1899.			
	To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1899, as per Act of Congress approved March 2, 1887		$15,000 00
June 30—By	Salaries	$6,619 96	
	Labor	4,578 55	
	Publications	169 14	
	Postage and stationery	152 96	
	Freight and express	205 85	
	Heat, light, and water	222 49	
	Chemical supplies	187 02	
	Seeds, plants, and sundry supplies	519 34	
	Feeding-stuffs	440 40	
	Library	77 61	
	Tools, implements, and machinery	278 90	
	Furniture and fixtures	100 55	
	Scientific apparatus	74 20	
	Traveling expenses	600 84	
	Contingent expenses	26 50	
	Buildings and repairs	745 69	
	Totals	$15,000 00	$15,000 00

We, the undersigned, duly appointed Finance Committee of the Corporation, do hereby certify that we have examined the books and accounts of the Agricultural Experiment Station of the University of California, for the fiscal year ending June 30, 1899, and that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000, and the corresponding disbursements $15,000; for all of which proper vouchers are on file and have been by us examined and found correct.

And we further certify that the expenditures have been solely for the purposes set forth in the Act of Congress approved March 2, 1887.

A. S. HALLIDIE,
ALBERT MILLER,
Finance Committee.

I hereby certify that the foregoing is correct, as shown in the books of the Agricultural Experiment Station of the University.

John J. Herr,
Auditor.

The Agricultural Experiment Station of the University of California, in Account with the United States Appropriation, 1899-1900.

		CR. 1899–1900.	DR. 1899–1900.
1900.			
	To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1900, as per Act of Congress approved March 2, 1887		$15,000 00
June 30—By	Salaries	$7,184 96	
	Labor	4,421 46	
	Publications	135 69	
	Postage and stationery	274 75	
	Freight and express	115 87	
	Heat, light, and water	276 27	
	Chemical supplies	523 32	
	Seeds, plants, and sundry supplies	407 30	
	Feeding-stuffs	193 90	
	Library	73 62	
	Tools, implements, and machinery	479 14	
	Furniture and fixtures	4 95	
	Scientific apparatus	83 80	
	Live stock	67 50	
	Traveling expenses	537 50	
	Contingent expenses	29 50	
	Buildings and repairs	190 47	
	Totals	$15,000 00	$15,000 00

We, the undersigned, duly appointed Finance Committee of the Corporation, do hereby certify that we have examined the books and accounts of the Agricultural Experiment Station of the University of California, for the fiscal year ending June 30, 1900, and that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000, and the corresponding disbursements $15,000; for all of which proper vouchers are on file and have been by us examined and found correct.

And we further certify that the expenditures have been solely for the purposes set forth in the Act of Congress approved March 2, 1887.

A. W. FOSTER,
I. W. HELLMAN,
GEO. C. PARDEE,
Finance Committee.

I hereby certify that the foregoing statement is correct, as shown in the books of the Agricultural Experiment Station of the University.

JOHN J. HERR,
Auditor.

The Agricultural Experiment Station of the University of California, in Account with the United States Appropriation, 1900–1901.

		Cr. 1900–1901.	Dr. 1900–1901.
1901.	To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1901, as per Act of Congress approved March 2, 1887		$15,000 00
June 30—By	Salaries	$7,318 26	
	Labor	4,598 82	
	Publications	118 68	
	Postage and stationery	193 55	
	Freight and express	145 03	
	Heat, light, water, and power	244 20	
	Chemical supplies	183 37	
	Seeds, plants, and sundry supplies	464 03	
	Feeding-stuffs	109 00	
	Library	219 68	
	Tools, implements, and machinery	531 90	
	Furniture and fixtures	188 00	
	Scientific apparatus	41 50	
	Traveling expenses	559 90	
	Contingent expenses	42 50	
	Buildings and repairs	41 58	
	Totals	$15,000 00	$15,000 00

We, the undersigned, duly appointed Finance Committee of the Corporation, do hereby certify that we have examined the books and accounts of the Agricultural Experiment Station of the University of California, for the fiscal year ending June 30, 1901, and that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000, and the corresponding disbursements $15,000; for all of which proper vouchers are on file and have been by us examined and found correct.

And we further certify that the expenditures have been solely for the purposes set forth in the Act of Congress approved March 2, 1887.

A. W. FOSTER,
BENJ. IDE WHEELER,
Finance Committee.

I hereby certify that the foregoing statement is correct, as shown in the books of the Agricultural Experiment Station of the University.

John J. Herr,
Auditor.

LETTER OF TRANSMITTAL.

President Benjamin Ide Wheeler:

Dear Sir: I transmit herewith the manuscript of a portion of the report, or record of work, of the Agricultural Experiment Station of the University for the years 1899 and 1900; a document long overdue, owing to the inadequacy of the appropriations for printing made by the Legislature preceding the last; on account of which the matter accumulated has had to lie over unpublished until the appropriation made at the last session became available, in July, 1901. When this time arrived, there was found to be urgent need of publishing, first, a large amount of matter of immediate importance, in the form of separate bulletins; of which sixteen have been issued since, viz., Nos. 125 to 140, amounting to 492 pages, as hereinafter detailed. The smallness of our force and the constant interruptions by duties on Farmers' Institute service rendered it impossible to prepare this report for the press simultaneously. And at the present time, it happens that the printing appropriation is again so nearly exhausted that it becomes necessary either to delay all publication until after July 1, or to divide the report into two parts. We have thought it best to adopt the latter alternative, however reluctantly. In this introductory general discussion I shall not, however, confine myself to the three years covered by the detailed record. For the future, I think it will be best to adopt the policy pursued by some other stations, of publishing a brief general and summary report every year, and to let the details follow in the form of either bulletins or appendices, as the printing funds and time of the staff may permit.

It is needless to discuss the detriment of this state of affairs, and the disadvantage under which it places the Station before the public as well as the authorities at Washington. The prompt publication of the results of work actually done is most essential to the standing of the Station work with the people of the State, and to its practical usefulness. At times the demand for information has been so pressing that brief typewritten or mimeographed summaries, and even corrected proof-sheets, have been sent out in response. It is evident that one of the greatest needs of the Station work is more adequate provision for publication, since with the rapidly increasing mailing list the printing of 10,000, instead of the 6,000 to 7,000 copies heretofore struck off, has already become necessary. Even with this increased number it is necessary to restrict unduly the distribution of Station literature at the Farmers' Institutes, which offer the most favorable opportunity for the wider popularization of the Station work, and for enlisting the interest of the farming population for coöperative work and observation; which are so necessary in view of the wide diversity of soils and climates in this State.

The *correspondence* of the Station, and with it the clerical work in the Director's office, has experienced a heavy increase, partly on account of the increase in the staff and its corresponding diversification of subjects.

The number of letters received daily ranges from fifty upwards; the number of letters written by members of the staff in reply ranges between 6,500 and 7,000 annually; the requests for bulletins or information that can be conveyed in printed form make up the balance of the replies to correspondents.

In selecting from the mass of material on hand the topics for the present publication, the aim has been to present the results of most immediate general interest rather than the detailed records of long series of work, which are reserved for the second part. Among the latter will be the record of over 300 *analyses of waters*, which were called for to an unusual extent on account of the distress caused by the deficient rainfall of the past three years; bringing about the search for new supplies, too frequently of doubtful or injurious character on account of excessive saline contents, rendering them unsafe for either domestic or irrigation use. A special research into the subterranean sources of supply in the San Bernardino Valley was made by myself, in connection with previous observations in the same region; it will be published as a special bulletin by the U. S. Department of Agriculture. The deficiency of rainfall has, in fact, been a largely governing factor in the work of these years, even to the extent of abridging materially the culture work at the southern substation, where at times water could not even be purchased when needed, where previously it had been supplied gratuitously; and where our pumping outfits failed to secure an adequate supply. As usual, however, these seasons of scarcity have been prolific of valuable experience, which will greatly mitigate the effects of such visitations in the future.

Among our most valuable investigations have been those on *green-manure plants*, the importance of which has been increasingly appreciated, so that we have had no difficulty in securing the coöperation of numerous intelligent farmers in our experiments, many of which were conducted in coöperation with the Department of Agriculture. The wide range of climates in this State renders these investigations quite complex and protracted, inasmuch as the plants found suitable in one portion of a region may be wholly unsuited to others, even within the same county.

Among the *culture investigations* carried on coöperatively with the Department of Agriculture for several years is that regarding the changes which northern-grown, glutinous grain undergoes when grown in our hot, dry climate and calcareous soils. The increase of starch and change of form have been very strikingly shown in the wheat-grain. Numerous seeds as well as plants and scions sent by the Department have been and are under trial at Berkeley as well as at our several substations, and many have been distributed in the State; as is shown in detail in the report on plant distribution by Prof. Wickson, given below. As was natural, very many such trials failed merely on account of the dry seasons, and the consequent discouragement of growers diminished the demand for the seeds and plants offered for distribution. Nevertheless, the responses made embrace some very definite and important results.

The *entomological work* has been somewhat slackened by the absence on leave of Prof. C. W. Woodworth during the year 1900–1. Current work and correspondence, however, were efficiently attended to by Mr. Carrol Fowler, who acted as Prof. Woodworth's substitute during the time. The record of this work is given below; in addition, Mr. Warren T. Clarke's important work on the life history and control of the potato-worm was mainly done during this time, and has been published in bulletin form (No. 135). Mr. Clarke has, since January 1 of the present year (1902), been employed in similar special work on the peach moth in the Sierra foothills, apparently with great success in controlling this serious fruit pest. He has already shown that by spraying at a proper time in the spring, 90 to 95 per cent of the moths may be destroyed.

In *viticulture* our investigations in vinification have been brought to a close, in view of the large amount of attention given to this subject in the past; the only work done in this line being the examination of wine samples sent in for analysis or for determination of their diseases or faults, and the remedies to be applied. It has seemed more important to direct our attention to the testing and introduction of phylloxera-resistant stocks and their adaptations to different varieties of grapes, and to the methods of grafting them. In pursuance of this plan Mr. Bioletti, in charge of this branch of work, issued Bulletin No. 127, on the subject of Bench-grafting Resistant Vines, in which the results of work done at the viticultural substation kindly placed at our disposal by Mr. J. K. Moffitt, of San Francisco, on land near St. Helena, Napa County, were reported and discussed. This bulletin has been largely instrumental in causing the wider adoption of bench-grafting instead of the dilatory and unsatisfactory practice of grafting in the vineyard, which in the past has almost universally prevailed. Our work in this line was brought to a close by the discovery, by Mr. Bioletti in January, 1901, of the invasion of the Fresno raisin vineyards by the phylloxera. The St. Helena station was therefore abandoned; and as a preliminary exploration of the Fresno region by Mr. Bioletti in the spring of 1901 developed quite a serious condition in a portion of the vineyards east of Fresno City, Mr. E. H. Twight, a graduate of the Montpellier College of Viticulture, was appointed (vice A. M. dal Piaz, resigned), with a special view to the inauguration of a series of experiments with resistant stocks in the Fresno region; where the prohibition of the importation of cuttings (since removed by the Board of Supervisors) had prevented such tests being made in advance of a possible invasion. A special bulletin on the phylloxera (No. 131) was published in May, 1901, and an importation of a number of new and promising resistant stocks from France was ordered by us early in 1901. These have since arrived in good condition, and have, together with the standard varieties already in use, been planted in seven different experimental plots in the Fresno region. A detailed survey of the extent of the invasion was made by Mr. Twight in the summer of 1901, and a small map showing the results was made and sent to the county authorities and others interested. It is hoped that thus, with the coöperation of the vineyardists, the dangerous enemy of the raisin and vine industry will be measurably headed off from further progress. With a view to "taking time by the forelock," the tests of resistant stocks have been further extended at the substations; at none of which, however, the insect has thus far appeared. The utter unsuitableness of the Berkeley climate to grape culture renders it inexpedient to attempt more than propagation of vines at the Central station, tests made during the last two years having proved that even bench-grafting can not be successfully carried out in the coast climate.

In the summer of 1901 Mr. Bioletti received a call to a government position near Cape Town, South Africa; in pursuance of which he resigned in December, 1901. Prior to leaving, however, he completed the experiments on the *pickling of olives* begun in 1900, and published the results in a bulletin (No. 137), which has most usefully served as a guide in putting up the olive crop of the past year. With this publication our special work on olives, which has thus far occupied considerable space in our program, has also been measurably brought to a close for the present, and with the departure of Mr. Bioletti, whose wide experience in both viticulture and olive culture we will sadly miss in the future, olive culture will fall into its natural place in Prof. Wickson's general course and studies in horticulture.

A general presentation of the *work of the substations* during the period embraced in the detailed record of work, here contemplated, is given below by Inspector Shinn. As already stated, the substation work has been severely handicapped by the three dry seasons just elapsed, to which a fourth seems about to be added.. It has nevertheless seemed, with all allowance for these unusual conditions, that the active work at one of the stations—that near Paso Robles—might be partially discontinued, while still maintaining there a workman in charge, pending the completion of some remaining culture experiments in certain lines, not yet fully tested. A special bulletin, embodying the main results reached during the active occupancy of this station in the past, will before long be published.

The pressing needs of extending investigations in other directions seem to necessitate the curtailment of some of the lines previously pursued to a sufficient extent for present requirements. Upon the retirement of Inspector Shinn, who has ably administered the substations since 1890, at the end of the present financial year, it is proposed, now that the plantings have reached their full bearing age, to increase materially the investigation of special horticultural problems, by the employment of a horticultural specialist, under the direction of Prof. Wickson.

The *tree-culture* or forestry stations at Santa Monica and Chico, transferred to the University by the State in 1892, have, in the absence of State appropriations, been maintained on the small allowance made from the University fund; a number of new species, especially of eucalypts, partly supplied by the Department of Agriculture, have been added, the existing trees cared for, their seeds collected for distribution, buildings kept in repair, and water-supply materially increased at the Santa Monica station. More than this could not be accomplished with the small amount of funds available. I would strongly recommend that a plantation of several acres of cork oaks be made, preferably at the Chico station, where additional land for this purpose could doubtless be obtained. The world's cork supply is becoming more and more inadequate; the suitability of California for the growth of this oak has been abundantly demonstrated, but the scattered trees already planted are constantly being destroyed by accident or design, and an investment so long in maturing does not appeal to the present race of Californians as yet. The University as a perpetual institution seems to be almost the only agency through which a practical demonstration of this important culture can now be made.

While the provision for *instruction in dairying* has been an exceedingly important and long-wished-for addition to the equipment of the College of Agriculture, and has been complemented by the equally long-called-for appointment of a *veterinarian*, experimental work in these lines has but just begun, by a series of feeding experiments with milch cows carried out by Mr. Leroy Anderson in the autumn of 1900, to be detailed in Part II of this publication. The veterinarian, Dr. A. R. Ward, has been repeatedly called to different parts of the State for the investigation of animal diseases, notably swine plague and a cattle disease which has proved very fatal in parts of Southern California. Great interest has been manifested in such investigations all over the State, to the extent of rendering it advisable to suspend instruction in the regular dairy course for one term, in order to enable Mr. Anderson to visit such creameries and cattle ranches as called for advice in perfecting their operations. The attendance of thirty-eight students, ranging in age from seventeen to fifty years, on the short dairy course, and the request that the latter should hereafter be longer than the nine weeks first allowed, emphasize the wide interest awakened by this work and promise increasing usefulness when the equipment shall have been completed, so that a dairy herd will be available in the immediate vicinity for both practical study and experiment.

The work in the *chemical* and *physical laboratories* has been as varied and exacting as usual; rather more so on account of the stress arising from the successive dry seasons. The failure of crops at many points raised endless questions as to the cause of the trouble, whether lack of moisture or of available plant food, or both. The call for such investigations has at times been overwhelming (over 300 in one season alone) and has taxed severely especially the time of Prof. Loughridge; so that the paid aid of advanced students to help in clearing the docket has been largely employed. It has also been necessary to devise short methods for the accomplishment of the most needful work of this character, which have of course been well tested by comparison with the usual analytical methods. In a very large number of cases it was found that lack of moisture at the deep roots was the cause of the observed lack of thrift, and that fertilization would be absolutely useless; thus saving a heavy, useless outlay to the persons interested.

Investigations of various *native* and *foreign forage* and other culture plants for their nutritive qualities have been numerously made; and the analyses of fruits from various portions of the State have been continued as heretofore. The analyses of *Paris greens*, in pursuance of a law enacted at the last session of the Legislature, has occupied considerable of the time of Mr. Colby, but has been eminently useful in establishing the fact that manufacturers can readily produce greens that will not injure the leaves of deciduous trees, even in the hot summers of the arid region; and also in inducing a more uniform and rational method of analysis to be accepted by the chemists of other states, whose results had frequently contradicted ours.

Investigations on the relations of humus to nitrification, and pot-culture experiments to determine the minimum limits of nutrients in soils compatible with normal plant growth, have been in progress for some years, but are not yet ripe for publication.

A *soil map of the State*, embodying the observations and corrections made since the map exhibited at the World's Fair at Chicago was compiled, is in process of preparation by Prof. Loughridge. The basis of the soil divisions outlined is not merely the physical nature, but also the geological relations, and the mineralogical, botanical, and chemical characters of the several soil areas.

The investigation of *alkali soils* continues to occupy a large amount of time, as numerous specimens are constantly sent for examination as to possibility and mode of reclamation, and for the designation of crops adapted to them. In the latter respect we are now greatly aided by the observations made at the Tulare and Chino substations, as well as by the examination of samples collected by members of the staff whenever visiting alkali regions, who take every opportunity to observe results obtained in actual farm practice. A summary presentation of the results thus far obtained is given in Bulletin No. 133 by Prof. Loughridge, by whom most of this work has been done. His observations having demonstrated the especial sensitiveness of citrus trees to common salt, the work is often simplified by the determination of this compound alone where citrus trees are concerned. We have long been conscious of the fact that the *total* of salts in the soil gives but little definite information, and that the changes in the distribution of the salts constantly going on under irrigation render mapping of doubtful value save in case of districts being newly taken into cultivation. From this point of view the exploration of the large body of lands on the southern part of the Salton basin, since designated as the "Imperial" country, was undertaken by Assistant F. J. Snow in the winter of 1900–1901; but owing to his resignation the elaboration of the results could not, unfortunately, be made ready for publication until fifteen months afterward, when it was issued as Bulletin No. 140. Since then a botanical survey of the region by Assistant Davy has brought about the issuance of a supplement, by which the cultural possibilities of those lands are placed in a much more favorable light.

The addition to our staff of Prof. G. W. Shaw, formerly of Oregon, with a view to special instruction in the *sugar-beet industry*, will also result in the inception of more extended studies and experiments in that direction; for which the coöperation of the beet-sugar companies is promised. Among other matters it will be our special effort to bring the sugar-percentage of the roots to the highest amount possible in this favorable climate, by the systematic selection of mother-beets for seed.

Last but not least must be mentioned the researches on *nutrition* carried on by Prof. Jaffa since 1898, mostly in coöperation with the corresponding work of the Department of Agriculture, under the direction of Prof. W. O. Atwater. Two extended bulletins embodying Prof. Jaffa's work have already been issued by the Department, and another more extended investigation of nutrition under the fruitarian régime, to which California seems so especially adapted, is now in hand and will be elaborated in the East and in Europe during the year's leave of absence lately granted to him by the Regents.

A discussion of the progress and changes in *instruction* during the period covered by this communication is deferred to Part II; but it seems necessary to discuss in this connection the influence of the

Farmers' Institute branch of University Extension on the work of the Station.

The Farmers' Institutes, regarding which a detailed report is made by Prof. Wickson farther on, form undoubtedly one of the most important and directly beneficial activities of the College of Agriculture. This fact is emphasized by the commendatory resolutions and petitions sent to the Regents for a more frequent recurrence of institutes in the several localities. It is nevertheless certain that a compliance with these demands would still further aggravate the disabilities which the holding of the institutes even now imposes upon the staff and upon the regular work of the College and Station, by the continually recurring absences of the most valuable members on Institute duty. It has thus happened that during the past session over twenty-five per cent of the time assigned to certain courses has fallen out, to the great detriment of instruction; and that despite of the efforts of the conductors to adapt the time of the meetings as much as possible to the avoidance of such interruptions. The simultaneous interruptions of the experimental work are at least equally restrictive of efficiency, since as a rule there is no one to carry it forward during absences of those in charge of the specialties; which frequently results in the partial or total loss of work already done. It is obvious that unless the regular staff were relieved of the Farmers' Institute duties, the only remedy is the appointment of a sufficient number of assistants qualified to carry on the lecture courses and the experimental work during the absences of the regular staff, since the latter could not as a rule be replaced at the institutes by new appointees having but an imperfect knowledge of the special problems and local conditions in this State.

It appears to me that for the present, the best solution of these difficulties would be the adoption by this State of the same policy that prevails in almost every State in which Farmers' Institutes are in regular operation, namely, the direct appropriation by the State of a sufficient amount to defray the expenses of these meetings. Such appropriation should not be less than $6,000 per year (in other States the appropriations range from $5,000 to $15,000), rendering it possible to employ competent outside lecturers when obtainable, and also to employ the needful assistance for the home work during the necessary absences of the regular staff. In the end it will, of course, be desirable to employ a distinct set of officers for this service; but until competent men can be obtained, the expedient suggested seems to be the only feasible one.

I therefore respectfully suggest that steps be taken to secure, at the coming session of the Legislature, an appropriation of not less than $12,000 for Farmers' Institutes, to be expended under the direction of the Board of Regents of the University, in order to relieve the more than unsatisfactory state of affairs at present existing, in consequence of the superimposition of Farmers' Institute duty upon the already overloaded staff of the College and Station.

Respectfully,

May 12, 1902.

E. W. HILGARD.

LIST OF BULLETINS ISSUED SINCE REPORT OF 1898.

1899.

No. 125. Australian Saltbushes. By Charles H. Shinn and M. E. Jaffa. May.
126. Paris Green for the Codling-Moth. By C. W. Woodworth and Geo. E. Colby. December.

1900.

127. Bench-Grafting Resistant Vines. By F. T. Bioletti and A. M. dal Piaz. February.
128. Nature, Value, and Utilization of Alkali Lands. By E. W. Hilgard. March.
129. Report on the Condition of Olive Culture in California. By A. P. Hayne. May.
130. Preservation of Unfermented Grape-Must. By F. T. Bioletti and A. M. dal Piaz. August.

1901.

131. The Phylloxera of the Vine. By F. T. Bioletti. May.
132. Feeding of Farm Animals. By M. E. Jaffa and Leroy Anderson. June.
133. Tolerance of Alkali by Various Cultures. By R. H. Loughridge. August.
134. Report on the Condition of Vineyards in Portions of the Santa Clara Valley. By F. T. Bioletti and E. H. Twight. September.
135. The Potato Worm in California. By Warren T. Clarke. October.
136. Erinose of the Vine. By F. T. Bioletti and E. H. Twight. November.
137. Pickling Ripe and Green Olives. By F. T. Bioletti. December.

1902.

138. Citrus Fruit Culture. By J. W. Mills. January.
139. Orange and Lemon Rot. By C. W. Woodworth. February.
140. Lands of the Colorado Delta in the Salton Basin. By E. W. Hilgard, G. W. Shaw, and F. J. Snow. Supplement by J. Burtt Davy. February.

SPECIAL CIRCULARS SENT TO CALIFORNIA GROWERS.

Distribution of seeds, plants, etc., for each of the years 1899, 1900, 1901, 1902. By E. J. Wickson.

Brown Rot of Stone Fruits. By F. T. Bioletti. January, 1901.

Warning to Olive-growers. By F. T. Bioletti. October, 1901.

FARMERS' INSTITUTES.

By Edward J. Wickson.

Farmers' Institute work has continued since our last report with increasing interest and popularity. The number of institutes varies but little from year to year, not because many more could not be profitably held, but because the number reaches the limit of the funds available for traveling expenses and occupies all the time which the instructors of the College of Agriculture can spare from their regular duties at Berkeley. It is in fact quite clear that the present requirements for institute work are too great upon the strength of those who participate and trench too far upon instruction and research at the University. In our last report it was pointed out that in no other State is so much institute work done by the college staff as in California; indeed, the statistics presented in that report show that our staff accomplishes from three to seven times as much as is done by college instructors in other States. It would be very desirable, indeed, if this amount could be reduced. To this end two things are necessary: first, larger funds for expenses and for the employment of institute workers; second, the training of the latter.

The University of California has never had special appropriations for Farmers' Institutes such as are freely made in other States; the Regents are strongly impressed with the desirability of the effort and its acceptability to the farmers of the State, and they have provided for it as liberally as they could in view of the imperative necessities existing in other departments of the institution. It is time that this branch of University Extension was recognized and generously provided for by the Legislature of California, so that all the institutes which are earnestly called for could be held, and suitable publication of the proceedings could be made.

The second consideration, the training of institute speakers who shall be broadly acquainted with California conditions and the local phases of the agricultural industries, is not to be easily or rapidly secured. The States east of the Missouri River have hosts of available speakers whose experience and observation make them capable of giving instruction from State to State because similar natural conditions and similar lines of production so widely prevail. It is quite easy then for an institute manager at the East to select all the speakers he needs and make but comparatively slight requisition upon the teaching forces of the Agricultural Colleges. These speakers are of course thoroughly in sympathy with higher agricultural education and largely possessed of it either by systematic instruction or by their own efforts, and their work among the people is strongly promotive of the efforts of the agricultural colleges. We greatly need in California a force of institute workers of similar ability and with similar aims.

The situation here, however, is difficult. We have no closed season like the Eastern winter, during which even men of considerable producing interests may employ care-takers and go themselves upon institute campaigns for the promotion of higher agricultural aspiration and better agricultural practice which they conceive to be of great moment to their fellow farmers and which their own knowledge enables them to expound to their edification. In California there is no protracted leisure season. This makes it necessary to hold institutes throughout nearly the whole year, making appointments in the several districts as the time of lessened activity arrives in each. For this reason it is impossible to engage speakers for a short season of connected work, as is the practice in the East. Again, as the agricultural industries in California are diverse both in subject and in method and largely conditioned upon the special requirements of localities, it is very difficult to secure speakers who are broadly acquainted with the facts and able to speak intelligently about them. The members of the college staff, from their investigation of California agricultural phenomena and their opportunity for observation in all localities, become exceptionally informed upon the subjects of greatest interest and able to adapt them to local conditions. Much can be done by carefully selecting men who are masters of certain specialties and securing their services as expert speakers now and then in districts where their special knowledge is applicable to local interests. This, however, requires more funds than the University can devote to the effort, for these experts must be paid fair compensation for the time they take from their own pursuits. With such a force at command the University conductors can meet the demand for more institutes, and the instructors at the University may experience less interference in their regular work. But the organization of the work on this plan is more difficult than at the East, for the reasons stated. The speakers must be trained by suggestion and practice so that they may speak readily and acceptably, and the change of the weight of the work from the staff to the outside speakers must be gradual and proceed only to desirable limits.

In behalf of the members of the college staff it must be said that they participate earnestly and enthusiastically in institute work. They appreciate fully the fact that the close acquaintance with the diverse conditions which naturally exist in the State, and with the ingenious ways in which practical farmers are adapting their methods to accord with the teachings of their experience, gives them greater force as instructors and keener point as investigators. They appreciate, too, and enjoy the advantage of personal acquaintance with the people whose interests their services are designed to advance. Participation in Farmers' Institute work is clearly of advantage to the college staff, and there is no desire to escape from whatever amount of it can be carried without conflict with other duties and obligations. But it is quite essential that something should be soon done to remedy the difficulty which now exists.

Though the number of institutes does not vary greatly from year to year, for the reasons stated, there is a notable increase in the average attendance at the institutes. It has, on careful estimate, advanced twenty-five per cent since our last report, and other indications of heightened interest are also evident. Most of the meetings provide for a declaration to the Board of Regents of the University of appreciation of the work and a request for its continuance and extension. The localities desiring the meetings provide generously for the local expenses for accommodation, printing, advertising, etc.; they arrange for social features of much warmth and interest—in short, they manifest their deep interest both by participation in the meetings and by enthusiastic promotion of all that can add to their success. As heretofore, the University furnishes its representatives without cost to the locality.

There has also been secured during the last two years a notable increase of local organizations in the agricultural interest. In Southern California particularly many farmers' clubs have been organized and constitute a most effective auxiliary to University Extension work as well as important centers of interest and activity in all progressive undertakings. The annual Farmers' Club Institute of the Southern California clubs is one of the greatest agricultural assemblies of the State, and exerts a wide influence. Active coöperation is also maintained with the granges, coöperative associations, and unions in all parts of the State. They are found to be most active and effective agencies for University Extension in agricultural lines.

To give an idea of the geographical distribution of the work the following list is prepared, giving the names of the towns in which institutes were held during the period from July 1, 1898, to June 30, 1901, covering three fiscal years. The numerals designate the number of institutes held at each place. The total number held is 245, or an average of nearly 82 each year. It is a safe estimate that 250 is the average attendance, and that above 20,000 persons are reached each year at the California institutes. In the list below many important towns are not mentioned. This is in part due to the fact that large towns as a rule are not best for institute meetings, and that the movement succeeds best when it comes nearest to the rural population in its distinctive centers. Occasionally, however, a locality has to be passed by because interest can not be aroused in the work, though due effort has been made. Such places are not permanently dropped; they are merely held in abeyance until the awakening comes, and it is encouraging to note that some places most indifferent at the beginning have become most enthusiastic afterward:

List of Farmers' Institutes, 1898 to 1901.

Adin	1
Alturas	1
Anaheim	1
Anderson	1
Arroyo Grande	3
Bakersfield	1
Banning	2
Beckwith	1
Bieber	1
Biggs	3
Bloomington	1
Brentwood	1
Buena Park	1
Burbank	1
Carpenteria	1
Castroville	1
Cedarville	1
Ceres	3
Chico	2
Chino Expt. Sta.	1
Chula Vista	1
Clearwater	1
Clements	1
Cloverdale	1
Colusa	2
Compton	2
Corning	3
Corona	1
Courtland	3
Cucamonga	2
Danville	1
Dinuba	1
Dos Palos	3
Downey	1
Easton	1
El Cajon	1
Elk Grove	3
Elsinore	1
El Monte	1
Escondido	1
Etiwanda	1
Eureka	1
Fair Oaks	4
Fallbrook	1
Fillmore	1
Florin	3
Fresno	3
Fullerton	2
Galt	1
Garden Grove	1
Geyserville	2
Glendora	1
Glen Ellen	1
Goleta	1
Grass Valley	3
Guinda	2
Hanford	3
Haywards	2
Healdsburg	3
Hemet	1
Highgrove	1
Highland	1
Hopland	1
Indian Springs	4
Inglewood	1
Ione	1
Julian	1
Kelseyville	4
Kingsburg	1
Lakeport	2
La Mesa	1
Lemon Grove	1
Lockeford	3
Lodi	3
Lompoc	1
Los Baños	2
Los Gatos	2
Liveoak	2
Madera	1
Marysville	1
Merced	2
Modesto	2
Montalvo	1
Moreno	1
Napa	3
Newcastle	2
Newman	1
Niles	1
Norwalk	1
Oakdale	1
Oceanside	1
Ontario	1
Orange	1
Orosi	2
Oroville	2
Pacific Beach	1

List of Farmers' Institutes, 1898 to 1901—Continued.

Pacific Grove	3	Ramona	2	Santa Maria	2	Two Rock	3
Pasadena	2	Red Bluff	1	Santa Rosa	3	Upper Lake	1
Paso Robles	3	Redding	1	Saticoy	1	Vacaville	1
Parlier	1	Redlands	1	Sebastopol	2	Ventura	1
Pescadero	2	Reedley	2	Selma	3	Villa Park	1
Perris	1	Rivera	1	Sierraville	1	Watsonville	3
Petaluma	1	Riverside	1	Soledad	1	Wheatland	1
Piru	1	Roseville	2	Sonoma	2	Westminster	1
Placerville	2	Rumsey	2	Stockton	3	Winters	3
Pope Valley	1	Salinas	3	Suisun	1	Woodland	3
Poplar	1	San Dimas	1	Tancred	1	Wrights	1
Porterville	3	San José	3	Traver	2	Yuba City	1
Potter Valley	2	San Luis Obispo	3	Tropico	1		
Pylema	2	Santa Paula	1	Tulare	1		

Besides participation in meetings listed above, the college staff has taken leading parts in various conventions in the agricultural interest, and has received many tokens of the kindly esteem in which their services are held.

PHYSICAL, CHEMICAL, AND FIELD WORK.

1. SOILS AND ALKALI.

During the period covered by this report, three years, there have been received for examination about 800 soils from 240 persons. The purpose of these examinations was in part to ascertain whether or not fertilization in any element was needed (in which case only cursory tests were necessary); in part as to what the soils were best adapted; and in part as to the presence of injurious amounts of alkali salts. The number of counties represented by the samples was 43.

The samples received were for the most part taken according to the printed directions of the Station.

Delays in examination and report of results were frequently occasioned by the failure of parties to accompany the samples with a letter giving the necessary data regarding the soils.

These examinations have, of course, occupied much of the time of the soil chemist and interfered with other investigations; but the importance of the work is recognized, for in the great majority of cases fertilization has not been found necessary and the farmer has thus been saved needless expense.

In nearly all of the soils examined, potash and lime have been found to be present in large and adequate amounts, and where any deficiency in plant-food has been found it has been with respect to either humus or phosphoric acid, or occasionally both. The exhaustion of humus has been caused by improvident cultivation and failure to recognize the importance of occasional green-manuring; and the result has been a gradual falling off in productiveness of the land, especially in grain fields, and sometimes seen in the yellowish, mottled, and sickly appearance of the leaves of orchard trees.

More complete analyses have been made of some important soils, which will be given in Part II of this report.

THE GOOSELANDS OF GLENN AND COLUSA COUNTIES.

By R. H. Loughridge.

The *gooselands*, so called because of the accumulation of water on the surface during the winter rains and hence the resort of great flocks of geese, cover a large area in the counties of Glenn and Colusa, bordered by the rich alluvial belt of the Sacramento River on the east and by the broad valley plain of the Sacramento Valley on the west; and reach from Willows on the north to within a few miles of Arbuckle on the southeast. The region varies in width from about 15 miles in its widest place on the north to about 6 miles in the middle and south, and has a length of about 30 miles. According to a sketch by Mr. Knock, the western border of this region passes southwesterly from the town of Willows (which is outside of the same) for about 5 miles, thence southerly for about 6 miles, turns suddenly eastward, crossing the railroad several miles south of Norman station; then southeastward for about 20 miles. The eastern boundary passes southeastward from Willows to within 2 or 3 miles of the Sacramento River, and turns southward following nearly the changes in the course of the river, and finally bending to westward southeast of Williams. The area thus covered is estimated to be more than 250 square miles. There are isolated and smaller spots of similar land southward in Yolo County.

Another characteristic of the region is the enormous amount of alkali salts in its soils, a depth of four feet often holding from 60,000 to 345,000 pounds, as shown by the analyses. Carbonate of soda, or "black alkali," forms but a small proportion of this alkali; common salt (chlorid of sodium) is frequently present to an injurious extent; but the main bulk of the alkali is glauber salt or sulfate of soda. In the reclamation of the land, therefore, the application of gypsum to correct the black alkali will seldom be necessary, and drainage to carry off the water and the other salts remains as the only method to be adopted to bring this region to a proper condition for cultivation. Even the removal of the excess of water alone by proper deep drainage will enable some crops, such as barley and wheat, to make a fair growth and yield, in presence of the alkali.

Willows Creek, on the north, conveys the waters of Clark's Valley watershed into this region and does not empty into the Sacramento River, as is the case with streams in other parts of the Great Valley; in fact, the gooselands area seems to begin just where the creek stops, and from this as an apex has the appearance of a great trough which has for ages received the alkali waters and sediments of Willows Creek. The region is underlaid by clay strata so impervious to water that during the winter season the surface presents a series of lakes in which wild geese find a home. It is treeless and largely without any vegetation whatever, the result of the presence of the alkali salts.

Because of its large area in the heart of so important an agricultural valley, and of the interest attaching to it, in that it is the most northerly occurrence of alkali thus far observed in this State, it was determined by the Experiment Station to study its features more closely. Mr. J. Burtt Davy, assistant in the Department of Botany, was therefore instructed to examine its flora and other features and to collect samples of characteristic soils for examination. Mr. Knock, County Surveyor of Glenn County, also kindly consented to give a brief account of its more important features. Their reports are given below.

The source of so great an accumulation of alkali salts in these soils naturally became a question of interest, and Mr. Knock, thinking that the watershed of Clark's Valley was responsible for the alkali, sent a sample of the water of one of the springs of Clark's Valley taken in April, and samples of the water of Willows Creek, from points just below the spring, from near the end of the valley, and from a point just outside of the cañon where the creek enters the Sacramento Valley; these samples were taken in June, 1899. The results of the analyses are as follows:

WATERS FROM CLARK'S VALLEY, GLENN COUNTY.

	Spring.	Willows Creek.		
	Clark's Valley.	Just Below Spring.	Near Mouth of Cañon.	Below Cañon.
	Grains per Gallon.			
Total residue by evaporation	85.51	159.05	47.89	82.35
Alkali salts	42.92	104.85	24.24	36.80
Non-alkali salts	25.54	27.44	18.98	28.03
Organic matter and chemically combined water	17.05	26.76	4.67	17.52
The alkali salts consist of—				
Sodium and potassium sulfates (glauber salt, etc.)	37.60	96.79	20.83	34.14
Sodium chlorid (common salt)	4.09	6.82	1.36	2.04
Sodium carbonate (sal soda)	1.23	1.24	2.05	.62
The non-alkali salts consist of—				
Calcium and magnesium carbonates	25.43	27.04	17.23	27.57
Calcium sulfate (gypsum)	.11	.40	1.75	.46

From the above it will be seen that while Willows Creek just below the spring is highly charged with soluble salts—nearly double the amount in the spring analyzed—it emerges from the cañon in the hills and enters the plain with very nearly the average of the spring.

These waters thus received by the gooselands would give to the land about 175 pounds of alkali per acre for each surface inch of water.

Soils.—The lands of the region are highly silty and clayey in character, as shown in the following physical analyses of the first and fourth foot respectively of a soil near Willows at the head of the trough:

MECHANICAL ANALYSES OF SOILS SOUTH OF WILLOWS, GLENN COUNTY.

Hydraulic Value. Velocity per Second.	Diameter of Grains.	Physical Characteristics.	First Foot. No. 2143.	Fourth Foot. No. 2146.
			Per cent.	*Per cent.*
64 mm.	.50 –.30 mm.	Very coarse sand	----------	1.02
32 mm.	.30 –.16 mm.	Coarse sand	2.02	3.79
16 mm.	.16 –.12 mm.	Medium sand	4.40	4.50
8 mm.	.12 –.072 mm.	Fine sand	1.52	6.65
4 mm.	.072–.047 mm.	Coarse silt	4.84	6.38
2 mm.	.047–.036 mm.		4.23	4.45
1 mm.	.036–.025 mm.	Medium silt	4.82	3.82
0.5 mm.	.025–.016 mm.		4.72	3.88
.25 mm.	.016– ? mm.	Fine silt	28.38	21.51
<.0023 mm.	?	Colloidal clay	39.54	38.72
			94.46	94.72

These soils do not differ very materially, except that the amount of very fine material is greater in the first than in the fourth foot. In each the clay and very fine silt comprise together above 60 per cent of the mass, and give to these lands their compact impervious character. The silty sediment, as deposited directly from the waters of Willows Creek, contains very little humus, but is highly calcareous and has a fair amount of phosphoric acid. The heavier soil of the gooselands (No. 2143), made up largely of silt and of the clay that escaped deposition at the mouth of the creek, has a low per cent of humus and a less amount each of phosphoric acid and lime than the sediment. This loss is doubtless due to the leaching effect of the stagnating waters, for the soil at four feet depth (No. 2146) is calcareous, though not as highly so as the original sediment.

Alkali Composition.—Examinations have been made of quite a number of the gooseland soils from different localities. Many of them were collected by Mr. J. Burtt Davy in his investigations on the plant growth of the region.

Alkali in soils from side of railroad 3 miles west of Colusa. Taken by F. J. Snow, 1898. Water was encountered in the third foot and it is probable that the results do not show the entire amount of alkali.

Depth.	Per cent in Soil.				Pounds per Acre.			
	Sulfates ...	Carbonate ..	Chlorid	Total	Sulfates (Glauber Salt)	Carbonate (Sal Soda).	Chlorid (Common Salt) ...	Total Alkali
Ditch near Railroad—								
1st foot	1.114	.017	.161	1.292	44,560	680	6,440	51,680
2d foot	1.007	.017	.054	1.078	40,280	680	2,160	43,120
3d foot	.700	.008	tr.	.708	28,000	320	......	28,320
4th foot	.336	.008	tr.	.344	13,440	320	......	13,760
Total	.789	.012	.054	.855	126,280	2,000	8,600	136,880
Wheat field adjoining the above—								
1st foot	.047	.004	tr.	.051	1,880	160	......	2,040
2d foot	.164	tr.	tr.	.164	6,560	......	......	6,560
3d foot	.138	.004	tr.	.142	5,520	160	......	5,680
Total	.116	.003	......	.119	13,960	320	......	14,280

The very large amount of salts found in the soil of the ditch by the railroad track is no doubt due to the percolation or seepage from the adjoining higher land; for in the wheat field near by, the amount is but little more than one tenth as large, and common salt and the carbonate of soda are notably absent. This result is a clear indication of the proper method of reclaiming these lands, viz.: deep drainage into lower levels, and cultivation of the surface soil to prevent any further rise of what might be below the drained stratum.

Alkali in soils from near Norman Station. The samples were brought by a party of San Francisco, and were taken at irregular depths to 3 feet from the surface.

Depth.	Per cent in Soil.				Pounds per Acre.			
	Sulfates	Carbonate	Chlorid	Total	Sulfates (Glauber Salt)	Carbonate (Sal Soda)	Chlorid (Common Salt)	Total Alkali
1-10 inches	.848	.004	.018	.860	29,600	130	600	30,330
10-14 inches	2.019	.009	.018	2.046	26,920	120	240	27,280
14-16 inches	3.067	.009	.022	3.098	20,450	60	150	20,660
16-25 inches	2.790	.013	.031	2.834	83,700	390	930	85,020
25-36 inches	1.754	......	.018	1.772	70,160	.....	720	70,880
Total in 3 feet	1.923	.006	.022	1.951	230,830	700	2,640	234,170

The large amount of salts in the third foot of the soil column shows that had the fourth foot been added the total salts would have been greatly increased.

The amount of carbonate is very small, that of common salt rather too large for some cultures, while that of sulfates is enormous.

Soils Samples Taken by Mr. Davy.—The following soils were taken by Mr. Davy, and the accompanying descriptive notes are by him:

ALKALI NEAR NORMAN STATION.

Alkali in soil from a dry alkali spot about one fourth of a mile east of Norman station, Glenn County. Vegetation is a sparse growth of Alkali-heath and Prostrate Saltbush; close by, but in less alkaline spots, Gold-fields, Gum-weed, Cressa, Barley-grass, Soft Barley-grass, and *Deschampsia calycina* are found, the Gold-fields being especially abundant.

Depth	Physical Characteristics.	Per cent in Soil.				Pounds per Acre.			
		Sulfates	Carbonate	Chlorid	Total	Sulfates (Glauber Salt)	Carbonate (Sal Soda)	Chlorid (Common Salt)	Total Alkali
ins.									
12	Hard gray soil	.684	....	.036	.720	27,360		1,440	28,800
12-24	Hard gray soil	.731	.034	.027	.792	29,240	1,360	1,080	31,680
24-36	Hard gray soil	.944	.076	.054	1.074	37,760	3,040	2,160	42,960
36-48	Hard gray soil	.372	.060	.036	.468	14,880	2,400	1,440	18,720
	Total in 4 feet	.683	.042	.038	.723	109,240	6,800	6,120	122,160

Neutralization of the carbonate of soda by means of gypsum and the removal of this and the other salts are the remedies suggested for this land.

ALKALI FROM NEAR WILLOWS.

Alkali in soil from the uncultivated plain about one half mile south of Willows, Glenn County. Taken in adobe-like hollows between the bare alkali spots. Some water had stood on this in the winter, and the spring vegetation has been quite luxuriant, consisting mainly of Goldfields, Vasey's Eryngo, Prostrate Saltbush, Long-winged Pepper-cress, and a few plants of Gum-weed. The soil is uniform throughout, dry and hard, and very difficult to bore with the auger.

Depth	Physical Characteristics.	Per cent in Soil.				Pounds per Acre.			
		Sulfates	Carbonate	Chlorid	Total	Sulfates (Glauber Salt)	Carbonate (Sal Soda)	Chlorid (Common Salt)	Total Alkali
ins.									
12	Dry gray soil	1.080	------	------	1.080	43,200	------	------	43,200
12–24	Dry gray soil	.549	.051	------	.600	21,960	2,040	------	24,000
24–36	Dry gray soil	.248	.076	------	.324	9,920	3,040	-----	12,960
36–48	Dry gray soil	.186	.102	------	.288	7,440	4,080	-- ---	11,520
	Total in 4 feet	.516	.057	------	.573	82,520	9,160	------	91,680

This soil contains a large amount of carbonate of soda, which, if it rose to the surface, would severely attack any plant roots. However, by the application of gypsum in quantities sufficient to neutralize the carbonate as fast as it came up, the injury from that source could be remedied. The sulfates present are too great in amount for most cultures, and should be removed from the soil if possible by deep drainage.

ALKALI FROM FIVE MILES SOUTHEAST OF MAXWELL.

Alkali in soil from the uncultivated plain five miles southeast of Maxwell, Colusa County. Taken in an alkali bog, dry when sampled, but reported to be so wet in winter as to mire a horse up to the girths; soil so loose that a walking-stick sinks over twelve inches without any difficulty. Vegetation is a dense growth of Gum-weed, also some Cockle-burr (*Xanthium canadense*), Cressa, and Sida. Neither Goldfields nor Alkali-heath tolerate this soil, though growing luxuriantly on adjacent areas. Water is reported to be about twenty feet below the surface, and to be quite brackish.

Depth	Physical Characteristics.	Per cent in Soil.				Pounds per Acre.			
		Sulfates	Carbonate	Chlorid	Total	Sulfates (Glauber Salt)	Carbonate (Sal Soda)	Chlorid (Common Salt)	Total Alkali
ins.									
12	------	.036	------	------	.036	1,440	-----	------	1,440
12–24	------	.229	.008	------	.237	9,160	320	------	9,480
24–36	------	.539	.017	------	.556	21,460	680	------	22,240
36–48	------	.734	.008	.018	.760	29,360	320	720	30,400
	Total in 4 feet	.385	.008	.004	.397	61,420	1,320	720	63,560

ALKALI, FOUR MILES EAST OF NORMAN.

Alkali in soil from a low spot four miles east of Norman station, Glenn County, on the road to Princeton. The center of the low spot is characterized by a dense growth of Alkali-heath and Cressa; while at the margin of the same low spot the Alkali-heath is replaced by a dense growth of Salt-grass.

From Center of Low Spot.

Depth	Physical Characteristics.	Per cent in Soil.				Pounds per Acre.			
		Sulfates	Carbonate	Chlorid	Total	Sulfates (Glauber Salt)	Carbonate (Sal Soda)	Chlorid (Common Salt)	Total Alkali
ins.									
12	Gray soil	.562	.017	.009	.588	22,480	680	360	23,520
12–24	Gray subsoil	1.811	......	.054	1.865	72,440	......	2,160	74,600
24–36	Yellow clay	2.390	......	.054	2.444	95,600	......	2,160	97,760
36–48	Yellow clay	2.125	......	.027	2.152	85,000	......	1,080	86,080
48–60	Hardpan	1.602	......	.027	1.629	64,080	......	1,080	65,160
	Total in 5 feet	1.698	......	.034	1.732	339,600	680	6,840	347,120
	From Margin of the same Low Spot.								
12	Gray soil	.171	.051	.009	.231	6,840	2,040	360	9,240
12–24	Yellow grit	.288	.068	......	.356	11,520	2,720	......	14,240
24–36	Yellow clay	.281	.119	......	.400	11,240	4,760	......	16,000
36–48	Yellow clay	.107	.136	......	.243	4,280	5,440	......	9,720
48–60	Yellow clay	.251	.102	......	.353	10,040	4,080	......	14,120
60–61	Hardpan	.029	.051	......	.080	390	680	......	1,070
	Total in 5 feet	.219	.095	.002	.316	44,310	19,720	360	64,390

These analyses show very characteristically the distribution of the salts within the low spots.

NOTES ON THE ALKALI LANDS.

By T. L. KNOCK.

There is in Colusa and Glenn counties, between the foothills of the Coast Range and the Sacramento River, a long depression or sink, known as the trough, or gooseland. It is nearly, if not quite, 30 miles long and from 6 to 10 miles wide. All of this land is highly impregnated with alkali (mostly glauber salt) from the foothills on the west.

The depression has been almost filled by the washings from these hills, and must at one time have been of great depth, for at the Rideout ranch, near Norman station, probably 10 miles north of the center of the region, an artesian well was dug some years ago, and the soil continued practically the same from the top down for nearly 1,000 feet. The soil is composed of the finer sediments from the hills, and if it were not so thoroughly permeated with alkali would be among the most fertile of California grain lands. This alkali all comes from a range of semi-mountains running north and south, parallel with and about

12 miles east of the true Coast Range. This range is drained on the east by a number of small creeks and sloughs that empty into the gooselands; on the west by Clark's Valley or Willows Creek. This creek runs north on the west side of the range for about 20 miles, and then breaks through and runs east into the head of the trough near Willows. These hills are composed almost entirely of sandstone interstratified with cemented gravels, imperfect slates, limestones, small seams of coal, and occasional beds of sea or estuary shells, and are capped with a heavy bed of conglomerate, the cementing substance of which is iron. This conglomerate has been washed away in the northeastern part and a large bed of rhyolite ash exposed, covering several miles. The stratum has been broken through by numerous dikes of basalt, trap, and syenite.

Almost every gulch in this range has its alkaline spring, the waters of which eventually reach the "gooselands." This depression has no outlet into the Sacramento River, except in the very highest stage of the winter floods; all of the lower portion of the waters is, therefore, removed only by evaporation from the surface. Of course, the alkali remains to destroy the fertility of the soil, which can only be restored by proper drainage. That this drainage is all that is necessary is proved by the fact that wherever the land is drained, even imperfectly as in the knolls in the worst alkali spots, that are raised only a few inches, the vegetation grows prolifically. The drainage of these lands can be accomplished in two ways: First, by a large and deep drainage ditch with lateral feeders to draw the waters from all parts of the land at once. This would necessitate a combination of all the owners of the affected lands in the form of a levee or drainage district, and would reclaim the land at once, for the salts being soluble in water, would be taken up and carried away by the waters of the winter rains, as they are drained away. Or the same may be done gradually by properly controlling the discharge of the creeks that run into the trough, and compelling them to deposit their sediments within contracted areas; thus raising the land within those areas and so producing a drainage in the raised tracts.

Willows Creek, for instance, has a watershed of 182 square miles and a fall of 10 feet to the mile in the lower part of its course, and more than twice as much in its upper reaches. When the banks are full (not overflowing) this creek discharges 3,240 cubic feet of water per second. All this water is heavily charged with sediment, and this is all deposited over a large extent of country, building up one year and tearing down probably the next. I made some experiments with the waters of this creek a year or two ago, and can safely say that there are 5 cubic inches of solid matter in each 1,000 cubic inches of water, and often twice as much.

If the waters running down this creek in flood times were compelled for one hour to deposit their sediments upon a check 1⅓ acres in extent, there would be found a deposit of the finest kind of soil one foot deep covering the whole check when the water all ran off. That is, it would cover 32 acres to that depth in twenty-four hours, or 96 acres in three days. Now this one foot in depth produces a drainage, and immediately changes the value of the land from almost nothing to $40 or $50 per acre for grain-raising alone.

There are no engineering difficulties to overcome, for the land is practically level, and small levees on each side of the creek and also on each side of the tract to be filled, are all that is needed. The creek must be confined within its banks until it reaches the land to be built up, and then be allowed to spread out all over this area. This spreading would check the velocity and cause most of the silt in suspension to be deposited at once. The water, not being able to penetrate deeply into the soil because of the underlying impervious clay, would then flow away in a broad sheet with greatly diminished velocity, and the alkali being soluble would go with it. The other creeks could be treated in the same way and the alkaline area would be contracted year by year. Nature is, of course, doing just this, but the area in which she impounds the sediments is so large that the effects are not noticeable to the ordinary observer. There are over 200,000 acres of these lands that, with an expenditure of probably less than $5 per acre, can be changed from almost a desert to one of the finest grain regions of the State.

ALKALI AND THE ALKALI INDICATORS OF THE GLENN COUNTY "GOOSELANDS."

By Joseph Burtt Davy.

In accordance with instructions from Professor Hilgard, a careful examination of the "gooselands" flora of Glenn County and the adjacent parts of Colusa County was undertaken in May, 1898. The following area was covered by the trip: From Norman to Princeton on the banks of the Sacramento River in Colusa County and return, thus crossing the entire width of the Glenn County gooselands; from Willows at the northern limit of the region across the alkali lands south of the town; from Maxwell at about the extreme southern limit of the gooselands to four miles southeast of town, thence westward to the foothills, crossing the western boundary of these lands, and the red wheat lands which border the foothills in a belt several miles wide.

On this trip twenty-three soil samples were taken, and a large number of interesting plants collected, including a remarkable genus of grasses (*Neostapfia*) entirely new to science, and another grass (*Heleochloa schoenoides*) not previously collected in California.

The soil samples were analyzed by Dr. Loughridge; and the tables of analyses and notes on the vegetation occurring where the samples were taken will be found on previous pages (25–27).

The "gooselands" receive their name from the large flocks of wild geese, which, migrating from the north in the late fall of the year, make these (then more or less flooded) lands their winter feeding-grounds. These geese are said to be plump, fat, and fit for food on their arrival, but to grow thin and strong-flavored before leaving.

The name "gooselands" is not restricted to the alkali plains between Maxwell and Willows, but is applied equally to other portions of the Sacramento Valley, where geese congregate in the winter; these lands are said to differ materially in character in different parts of the valley, and to be by no means confined to alkali flats.

The "gooselands" here referred to commence a few miles north of Arbuckle, and extend as far north as Willows and about five miles east and one half to two miles west of the main railroad track. They occupy what appears to be a depression between the rich alluvial river-bottom lands and the red-brown colluvial soil at the base of the foothills.

The soil consists for the most part of a heavy, impervious, light-gray clay with salts, of which glauber salt (sulfate of soda) forms the largest portion, sal soda (carbonate of soda) occurring only in small quantities. Two areas are particularly alkaline, the one about half a mile east of Norman, the other near Colusa Junction station; the soils appear to be less impregnated as we leave these spots in any direction.

A stiff, yellowish adobe occurs in larger or smaller patches, overlying the clay in places. In other spots large deposits of gravel and silt, overlying the clay, mark the winter course of foothill streams which lose themselves on the plain.

The alkali-charged clay is so impermeable, that even on cultivated areas water is said to penetrate only to the depth of the plow and only escapes by evaporation. An imperfect hardpan occurs between the third and fourth foot from the surface; it consists of small nodules not as completely cemented together as in some of the hardpans of the Tulare region.

The well water of this area tastes decidedly brackish. There is an artesian well at Norman, with but a poor flow, however, and there are several artesian wells near Willows; the water is reported as being warm, unpleasant to the taste, and only fit for cattle to drink.

Origin of the Gooselands.—The late State Senator John Boggs, who ranched for forty-five years at Princeton, suggested the theory that the whole valley floor was at one time occupied by this alkali-charged clay, and that the alluvial river-bottom lands and the red-brown soils at the base of the foothills are of more recent origin, superimposed by subsequent erosion of the hills. This theory seems to harmonize with the well-known rise of alkali salts through alluvial soils, in some cases, when subjected to irrigation. An examination of carefully preserved cores of the borings of wells in the river alluvium near Princeton would probably throw much light on this subject. The fact that these alkali deposits are so limited in surface-area may perhaps be due to the extensive deposition of silt and alluvium along the margins and at the mouths of the numerous mountain streams which lose themselves, at shorter or longer intervals, over the whole length of the valley. It is possible that all of the alluvial soils of the vicinity are underlaid by a stratum of alkali soil.

Another theory offered is that these alkali areas are only local sumps, sinks, or evaporating pans, for the alkali-charged waters of particular mountain streams which have not sufficient volume and force of water to carry their salts direct to the larger streams and thence to the sea. The cañon of the stream alongside of the road from Maxwell to Sites shows alkali outcroppings on its walls, usually with tufts of salt-grass (*Distichlis spicata*) marking the outcrop. There does not appear to be any alkali deposit where the stream cuts through the red-brown colluvial lands on the edge of the valley; it appears again only where the waters lose themselves on the gooselands.

With regard to the theory that deposits of alkali salts always indicate the former presence of sea-water, Professor Hilgard has pointed out that the occurrence of "alkali" salts in the soils of the arid regions is independent of either present or former marine conditions.

The salts are the educts of the soil from the weathering process, and in consequence of deficient rainfall have failed of being leached into the subdrainage. The point which still remains doubtful in the case of the gooselands of Colusa and Glenn counties is whether the deposit of the alkali salts is local or whether it is extensively distributed in the valley, merely covered with more recent deposits and liable to come to the surface with the application of irrigation water.

Aspect of the Gooselands.—The general aspect of the gooselands is that of a level plain, treeless except where at rare intervals a settler has planted Black Locust (*Robinia pseudacacia*) and Manna Gum (*Eucalyptus viminalis*) to protect his cottage and barn from the prevalent and strong north winds. The Coast Range Mountains rise blue and purple some ten miles to the west, reaching a considerable height in Snow Mountain. To the east, but at a much greater distance, the snowy peaks of the Sierra Nevada are seen; below them, more in the foreground, a fringe of trees casts its shadow in the water-like mirage which bounds the plain on that side, and marks the course of the Sacramento River ten miles east of the railroad track. A passing freight train appears to be floating on a lake, its size exaggerated and its shape scarcely recognizable on account of the reflection in the hot and dancing air. To the southeast the remarkably rugged outline of the Marysville Buttes rises abruptly from the plain beyond the river, and far to the north Red Butte indistinctly breaks the line of the horizon. When the north wind blows and the sky is quite clear a fine view is obtained of the snowy summit of Mount Shasta, where the waters of the Sacramento River take their rise.

Crops.—Much of the gooseland area is uncultivated, and according to Mr. Boggs has never been brought under the plow; the wild vegetation (Salt-grass, etc.) affords some pasturage for stock in the late spring and early summer. The less alkaline areas have been planted with wheat and barley and are said to yield a crop about two years out of three. The north winds are said to be so terrific as to frequently thrash out the grain in the fields by knocking the heads together.

Australian Saltbush.—The late John Lewis planted about one fourth acre of Australian Saltbush (*Atriplex semibaccata*) on his ranch. The plants were very healthy, most of them about two feet in diameter, but some three and even five feet; many volunteer seedlings were coming up between the rows, although the soil was hard and unbroken. The plot was in all respects a success, and shows clearly that *these gooselands could be turned into fine pasture land* if systematically planted with saltbush and other alkali-tolerant forage-plants.

Fruit Trees.—Several small orchards and vineyards have been planted near Maxwell and at other points, but owing to neglect are quickly dying out; it is said that peach trees die, apparently without reason, when about five years old, which may be due to the presence of an impenetrable alkali-hardpan. Frosts are often very severe, and although almonds, peaches, figs, and even oranges are successfully ripened in the vicinity, the climate appears to be too uncertain to render their culture a profitable enterprise. The fig thrives well in the sub-alkaline soils of Maxwell.

Windbreaks and Shade Trees.—The Black Locust (*Robinia pseudacacia*) and the Manna Gum (*Eucalyptus viminalis*) have been planted extensively as shade trees and windbreaks, and appear well adapted to the soil and climate; the Monterey Cypress (*Cupressus macrocarpa*) has been planted for the same purpose, but seems to be less at home than the others.

Native Vegetation.—The surface of the plain is almost level and but little diversified. Slight adobe hollows or "hog wallows," where the water stands a long time after rain, scarcely penetrating the hard, stiff clay, produce a growth of "Gold-fields" (*Bæria*), Gum-weed (*Grindelia camporum*), Western Fescue (*Festuca microstachys*), Vasey's Eryngo (*Eryngium vaseyi*), Soft Barley-grass (*Hordeum maritimum gussonianum*), Long-winged Pepper-cress (*Lepidium latipes*) or, under certain conditions, Salt-grass (*Distichlis spicata*), Alkali-heath (*Frankenia grandifolia*), and Cressa (*Cressa cretica truxillensis*). The intervening spaces, though but slightly elevated, produce a different and sparser vegetation; their ridges are often bare and white with alkali dust; Gold-fields, Eryngo, and Pepper-cress do not grow there at all, and Gum-weed is less abundant than in the hollows; Alkali-heath, Salt-grass, and Prostrate Saltbush (*Atriplex fruticulosa*) abound, and other species of *Atriplex* and *Tissa leucantha* are frequently met with.

The silty washes of winter streams from the foothills produce a flora entirely different from that of the surrounding plain. The winter floods bring down with them, among the sand and gravel, seeds of shallow-rooted annuals from the hill-slopes, and these finding congenial conditions produce a luxuriant and brilliant spring vegetation. The washes being of considerable length and comparatively level, so that seeds from a large area can be accumulated in a narrow space, often become veritable spring flower-gardens in an otherwise comparatively desolate waste.

Here and there a winter torrent has cut for itself a deep channel in the clay; this channel retains moisture long after the surrounding plain has dried up, and produces a luxuriant growth of grass and weeds, such as Bur-clover (*Medicago denticulata* and var. *apiculata*), Bitter Melilot (*Melilotus indica*), Stachys, Wild Clover (*Trifolium*), Darnel (*Lolium temulentum*, here mis-called Cheat and supposed to be a wet-season derivative of seed-wheat), Ray-grass (*Lolium perenne*, together with the vars. *italicum* and *multiflorum*), Canary-grass (*Phalaris minor* and *P. paradoxa*), Barley-grass (*Hordeum murinum*), Soft Chess (*Bromus hordeaceus*, here called "squaw-grass" and said to be driving out the Barley-grass), Soft Barley-grass (*Hordeum maritimum gussonianum*), a species of Carex, and other plants.

Alkali Indicators.—The most abundant and distinctly characteristic plants of the gooselands proper are, in order of prevalence: Alkali-heath (*Frankenia grandifolia*), Gum-weed (*Grindelia camporum*), Salt-grass (*Distichlis spicata*), Gold-fields (a species of *Bæria* or *Lasthenia*, especially prevalent on adobe patches), Cressa (*Cressa cretica truxillensis*), Sida (*Sida hederacea*), Long-winged Pepper-cress (*Lepidium latipes*), Tissa (*Tissa leucantha*), and Prostrate Saltbush (*Atriplex fruticulosa*).

Salt-wort (*Suæda torreyana*) was only found in one place, a low, strongly alkaline spot, near Colusa Junction station; but there it was very abundant and characteristic.

The entire absence of *Nitrophila* and *Salicornia* and the scarcity of *Suæda* apparently indicate lack of sal soda, which view has since been confirmed by Dr. Loughridge's analyses of the soil samples; the absence of *Allenrolfea* may be due to the same cause, or to lack of moisture.

Alkali-heath (*Frankenia grandifolia*) is the most characteristic plant of the area under consideration. Its perennial, deep-rooting habit of growth, which enables it to persist even in cultivated ground, renders it useful and dependable as an alkali indicator; wherever it occurs it may be looked upon as an indication of the presence of excessive quantities of glauber salt (sodium sulphate, Na_2SO_4), sometimes to the extent of 340,000 pounds per acre, and it may be taken as evidence that wheat can not be depended upon for a crop, and that the raising of stone fruits should not be attempted.

Only a few immature plants of a Centromadia (apparently *C. pungens*) were seen.

AN INVESTIGATION OF SOIL SEDIMENTS, AS FORMED UNDER ARID CONDITIONS, WITH REGARD TO THEIR PLANT-FOOD VALUE.

By L. M. Tolman.

In order to show the underlying conditions which suggest such an examination, and in order to make more clear the meaning of the results obtained, it will be necessary to state at the very beginning a few general facts as to the formation of soils and the effects of different climatic conditions. As soils are formed by weathering or disintegration of rocks, a difference in the agencies which bring about this weathering must have its effects on the soils.

These agencies which bring about soil formation are numerous and varied. Mechanical, such as the grinding action of glaciers, the wearing away by running waters; and chemical, such as the dissolving action of pure water and of water charged with carbonic acid, and oxidation by the oxygen of the air. Of course, there are many other means that aid, but these are enough to show the causes which are most actively at work in the formation of the two regional types of soils, the arid and the humid.

In general, it is mechanical agencies aided by the chemical changes brought about by the atmosphere that have most to do with soil formation in the arid parts of the earth; while in the humid regions it is the presence of a large amount of moisture that causes the decay of the rocks.

Rocks of the same nature will form soils entirely different because of the climatic difference in weathering. Granite will, under arid conditions, form a silty or sandy soil with only a small per cent of clay; while under the humid conditions, the feldspars will all be decomposed, and with the other soluble parts will go to form a heavy clay loam.

Thus it is that arid countries have chiefly light sandy soils and humid countries the clayey soils. It is this marked difference that at once suggests the idea that there would be a difference in the distribution of the plant-food in the different-sized grains or sediments, and shows the reason for making this investigation.

Soil Sediments.—It will also be necessary at the outset to define exactly what is meant by soil sediments and give the methods used in segregating them, and also the meaning and limits of arid conditions as they are considered in this investigation.

Even the most casual observer will note that nearly all soils are made up of various-sized grains, from coarse gravel down to the finest silts and the colloidal clay, a gelatinous mass, whose form can not be detected by the most powerful microscope.

These are the sediments under discussion, and in either a physical or chemical analysis of a soil would first be divided into two parts, "fine earth" and "coarse earth," as they are called. To make this separation, the soil is placed in a mortar and rubbed with a rubber pestle and then sifted with a ½ mm. sieve; that which is left in the sieve is the "coarse earth" and that which passes through is the "fine earth."

Thus the coarse gravel and sand, the undecomposed organic matter, such as roots and leaves, are eliminated, as none of this matter has been considered as of any value in plant nutrition. That this is true in a *humid region* there can be little doubt; but there seems to be no reason why the coarse grains of 1 mm. and 2 mm. in diameter and even coarser gravel of an *arid soil* should not be able to give some food to the roots of the plant, and the results of this investigation would certainly indicate that this is the case.

The fine earth is conveniently divided into ten divisions, which are separated, partly by sedimentation, and partly by the elutriator of Professor Hilgard, in which a column of water rising at a certain velocity carries off sediment of a certain size. Certain empirical rules have to be adopted in making such an analysis, as of course there is no natural line of separation. The following were the ones followed in this work:

The "*clay*" is that which remains in suspension for twenty-four hours in a column of still water 200 mm. high, although some of the finest silts are thus included with the true clay.

The .25 mm. hydraulic value means those grains that will be carried upward by water rising at the velocity of .25 mm. per second in the tube of the elutriator. The .50 mm. are obtained in the same way, and the others or coarser grains in the same way, doubling the velocity of the water each time.

An analysis of a soil made in this manner is reported in this order:

Clay	? .016 mm. diameter
.25 mm. hydraulic value	.016–.025 " "
.25– .50 " " "	.025–.036 " "
.50– 1.00 " " "	.036–.047 " "
1.00– 2.00 " " "	.047–.072 " "
2.00– 4.00 " " "	.072–.120 " "
4.00– 8.00 " " "	.120–.160 " "
8.00–16.00 " " "	.160–.300 " "
16.00–32.00 " " "	.300–.500 " "
32.00–64.00 " " "	

It is these sediments which are the subject of this investigation. The idea being to make complete analyses of a soil and of each one of the sediments derived from it, in order to see in which of the sediments the greater proportion of the available plant-food is held, and the relative values of the different-sized grains, as they are formed under typically arid conditions. It is generally considered that regions that have an average rainfall of less than 20 inches are arid, but a good deal depends on the distribution throughout the year

Of course, swamp and lake deposits and the disintegration of clay shales would form soils similar to those of the humid region, and therefore could not be considered as arid soils, no matter where they were formed. Then there are regions where the rainfall is very great in short seasons, and then follows a long dry spell, during which irrigation is necessary to produce crops. These also must be considered as arid.

The reason for taking these arid sediments in distinction from those of a humid soil was suggested at the beginning. There is a decided difference between them, and the conclusions drawn from an investigation of the humid soils do not seem to hold good when applied to arid countries.

At this point it will be necessary to discuss the results obtained by Dr. Loughridge in his investigation of a humid soil, in order that a clear idea may be had of the striking difference between the results and so, necessarily, between the conclusions drawn from them. (See Table No. 1.)

TABLE No. 1—ANALYSIS OF A HUMID SOIL AND ITS VARIOUS COMPONENT SEDIMENTS.

	Insoluble Residue	Soluble Silica	Potash (K_2O)	Soda (Na_2O)	Lime (CaO)	Magnesia (MgO)	Br. Ox. Man. (Mn_3O_4)	Peroxid Iron (Fe_2O_3)	Alumina (Al_2O_3)	Phosphoric Acid (P_2O_4)	Sulfuric Acid (SO_3)	Organic and Chemical Water	Total
Aver'ge of humid region	87.68	4.21	.21	.09	.10	.22	.13	3.13	4.29	.11	.05	3.64	100.17
Average of arid region	76.13	7.26	.72	.26	1.36	1.41	.05	5.75	7.88	.11	.04	4.94	99.99
Benton Co., Miss., entire soil	70.53	12.30	.63	.09	.27	.45	.06	5.11	8.09	.21	.02	3.14	100.63
Clay, 21.64%	15.96	33.10	1.47	----	.09	1.33	.30	18.76	18.19	.18	.06	9.00	100.14
A	4.35	7.17	.32	--	.03	.29	.06	4.06	3.97	.04	.01	1.33	21 64
B	15.26	2.66	.13	.02	.05	.09	.01	1.10	1.75	.04	.00	.67	21.64
.25 mm., 35.10%	83.01	7.11	.41	.26	.15	.36	.00	3.55	3.49	.07	.02	3.66	99.60
A	27.32	2.87	.16	.10	.05	.14	.00	1.40	1.36	02	.02	1.66	35.10
B	28.72	4.31	.22	.03	.09	.15	.02	1.79	2.83	.07	.007	1.10	35.10
.25 to .50 mm., 13.67%	94.13	2.35	.12	.21	.09	.10	.00	1.03	1.21	.02	.03	.92	100.21
A	12.72	.32	.01	.02	.01	.01	.00	.14	.17	.00	.00	.28	13.67
B	9.63	1.68	.08	.01	.03	.06	.008	.69	1.10	.00	.00	.41	13.67
1 mm.							.36						
Sum of what was found	71.89	10.36	.49	.12	.09	.44	.06	5.10	5.51	.06	.02	3.64	98.28

A is amount in whole soil. B, the pro rata of the sediment. .25 mm., .50 mm., 1 mm. refer to hydraulic value. Method of analysis, 5 days' digestion in 1.115 HCl.

In the table the percentage composition of each sediment itself is given; then the results are calculated (A) with reference to the soil; and finally in (B) are given the pro rata or what would be present if distributed according to the percentage of each sediment.

Table No. 1 was prepared from a report of his work and shows several facts very strikingly. That practically all of the plant-food is in the clay and .25 mm. sediment and that the .50 mm. and 1 mm. are nearly insoluble, and of no value to the soil except in effect on its texture, being nothing but grains of quartz mixed with other very insoluble minerals, such as mica and tourmaline, on which the acid has no effect. It shows that there has been an excessive concentration of the soluble parts in the clay, it having a great deal more than its pro rata, as shown from a comparison with the soil; while in the .25 mm. there is considerably less than its pro rata, and the .50 mm. is far below, showing that the constant leaching of an excess of water has carried all the soluble part into the clay and only the most insoluble part has been left in the other sediments. A sandy land under such conditions would be exceedingly poor, and such are the facts of the case; and so it is that in *a humid region a large amount of clay is considered necessary if a soil is to be lasting;* this is the reason that Eastern people are afraid of the sandy lands of California.

But in all arid countries there is a tendency on the part of soils to be sandy, and when we consider that the arid soils of the world have longest been under cultivation and have held out and been continually fertile, we must acknowledge that there must be a great difference between the sandy lands of the arid and the sandy lands of the humid parts of the world. A microscopical examination of the two would at once give a hint as to the cause; for the sand of the humid region is found to be only quartz and the most undecomposable minerals, while the sand of the arid region is made up of finely powdered minerals, many of which are easily decomposed, and in the presence of much moisture would have broken down into clay. The probable reason why these soils are so fertile is that these minerals are weathered on the surface to a greater or less degree, and this weathered coating is just as readily soluble to the acids of the plant roots as if it had been washed into the clay. It is for this reason that it seems highly possible that even the very coarse grains should be of more than mechanical value to the soil.

In order to further show these theories to be true, a number of analyses were made of two different soils of California. One was selected from the Experiment Station near Pomona to represent the valley of Southern California; and one from Tulare Experiment Station to represent the great central valley of the State.

The Chino soil was a gray sandy loam, and that from Tulare was very similar, as a comparison of the mechanical analyses will show. (Report of California Experiment Stations, 1892–3.)

	Pomona. No. 1281.	Tulare. No. 1159.
Coarse earth, above .5 mm. diameter	10.00	1.96
Fine earth	90.00	98.04
	100.00	100.00
Colloid clay	7.60	5.71
.25 mm. hydraulic value	18.53	10.94
.25– .50 " " "	5.49	4.10
.50– 1.00 " " "	3.92	5.48
1.00– 2.00 " " "	6.40	7.05
2.00– 4.00 " " "	7.92	9.06
4.00– 8.00 " " "	11.87	.71
8.00–16.00 " " "	16.36	23.83
16.00–32.00 " " "	14.65	13.37
32.00–64.00 " " "	5.10	.89

Both of these are typical arid soils with a low per cent of clay and less than half of the soil finer than 2 mm. hydraulic value. The rainfall at Chino is a little less than 20 inches, while that at Tulare is probably below 10 inches. Both soils have the high contents of lime (CaO) and potash (K_2O) usual in arid soils. The chemical analyses of the two soils also were very similar, as can be seen from Table No. 2.

TABLE No. 2.

	Insoluble Residue	Soluble Silica	Potash (K_2O)	Soda (Na_2O)	Lime (CaO)	Magnesia (MgO)	Peroxid Iron (Fe_2O_3)	Alumina (Al_2O_3)	Phosphoric Acid (P_2O_5)	Organic Matter and Water	Total
1281. CHINO SOIL—percentage in soil	65.58	12.78	.76	.15	2.24	.52	6.32	7.98	.20	2.95	99.60
Clay, 7.60%	25.52	22.64	2.22	.26	1.90	2.30	14.64	17.77	.56	12.30	99.87
A (in whole soil)	2.09	1.70	.16	.01	.14	.17	1.11	1 35	.04	.93	7.60
B (pro rata of sediment)	4.98	.97	.05	.01	.17	.03	.48	.60	.01	.22	7.60
.25 mm., 18.53%	43.03	26.82	1.33	.20	2.88	1.60	6.82	9.18	.35	7.78	100.10
A	7.97	4.96	.24	.03	.53	.29	1.26	1.76	.06	1.44	18.53
B	12.15	2.37	.14	.02	.41	.09	1.17	1.47	.03	.54	18.53
.50 mm., 5.49%	62.24	14.60	1.00	.28	2.11	.45	2.18	9.22	.34	3.75	100.25
A	3.63	.80	.05	.01	.11	.02	.11	.51	.01	.20	5.49
B	3.60	.70	.04	.008	.12	.02	.34	.42	.01	.16	5.49
1 mm.	Lost.								.30	-----	-----
2 mm., 6.40%	65.79	12.53	.86	.23	2.87	1.13	5.63	8.65	.29	2.13	100.20
A	4.21	.80	.05	.01	.18	.07	.36	.55	.01	.13	6.40
B	4.19	.81	.048	.009	.14	.03	.40	.51	.01	.18	6.40
4 mm., 7.92%	70.13	11.25	.76	.06	2.55	.36	5.89	7.56	.27	1.55	100.04
A	5.55	.89	.06	.004	.20	.028	.43	.59	.017	.12	7.92
B	5.19	1.01	.06	.01	.17	.04	.49	.63	.015	.23	7.92
8 mm., 11.87%	76.63	8.28	.52	.26	2.20	.93	9.25		.26	1 29	99.80
A	9.09	.98	06	.03	.26	.10	1.19		.03	.25	11.87
B	7.78	1.51	.09	.01	.26	.06	1.67		.02	.34	11.87
16 mm., 16.36%	76.80	8.44	.37	.15	2.18	.33	4.63	5.64	.16	1.07	99.78
A	12.65	1.38	.06	.03	.36	.06	.76	.92	.03	.17	16.36
B	10.72	2.08	.12	.03	.37	.08	1.03	1.30	.03	.48	16.36
32 mm.	85.51	5.18	.31	.07	1.35	.33	3.00	3.14	.13	.87	99.89
A	12.54	.75	.04	.01	.24	.04	.43	.44	.01	.12	14.65
B	9.51	1.97	.11	.02	.43	.07	.92	1.16	.03	.53	14.65
64 mm.	81.65	6.05	.39	.11	1.90	.26	3.55	4.65	*	1.44	100.00
A	4.16	.30	.01	.00	.09	.02	.18	.23	*	.07	5.10
B	3.33	.65	.03	.00	.12	.03	.32	.40	*	.16	5.10
1159. TULARE SOIL	72.98	6.60	1.20	.52	1.86	1.81	6.86	5.66	.10	2.54	100.22
8 mm., h. v.	76.32	9.94	.82	.12	1.49	1.13	4.14	4.70	.13	1.29	100.11
1 mm.. diameter	90.77	3.83	.25	.12	.53	.27	1.61	2.04	.06	.44	99.94
2 mm., diameter	93.53	2.31	.15	.12	.24	?	2.95		.08	.45	99.82

A and B determined same as in Table No. 1. The analysis of No. 1159 taken from California Station Reports. * The phosphoric acid was not determined. The manganese and sulphuric acid are omitted from the table.

Sediments of Fine Earth.—A complete analysis of the soil and of each one of the sediments, with the exception of the 1 mm. hydraulic value, which was lost, was made of the Chino soil. Of the Tulare soil only the sediments of 8 mm. hydraulic value and the 1 mm. and 2 mm. diameter were taken, in order to see whether the coarse earth contained anything of value. In discussing the table special attention will be paid to the potash (K_2O), lime (CaO), and phosphoric acid (P_2O_5), as the investigation has been with the idea of studying the chief elements of plant-food.

The soils themselves, when compared with the average of the humid regions, show most strikingly the difference between arid and humid soils. The 1.20 per cent of potash and 1.80 per cent of lime in the Tulare, No. 1159, are remarkable, even in an arid region.

The *clay* of the Chino soil, of which there was only 7.60 per cent in the soil, is the first of the sediments to be considered.

The analysis shows a decided concentration of soluble matter in it, viz., 2.22 per cent of potash and .56 per cent of phosphoric acid, or three times as much as their pro rata; but for some reason, hard to say, the lime is less. Perhaps the latter is in a more readily soluble condition in the clay and has been leached, by even the small amount of rain, into the subsoil.

But when we consider how small a portion of the soil the clay really is, we can see how very small a part of the plant-food of the whole is contained in it. We find only about one fifth of the potash and phosphoric acid, and one tenth of the lime. This is very different from the conditions shown by the analysis of humid clay (Table No. 1), in which one half of the potash and lime was found.

The next sediment, .25 mm. hydraulic value, when examined under the microscope appeared very much mixed, being composed of the very finest silt, that would just settle through 200 mm. in twenty-four hours, to the largest that would be carried off by a velocity of .25 mm. per second. With its 1.33 per cent of potash, 2.88 per cent of lime, and .35 per cent of phosphoric acid, there is a decided excess of plant-food in this sediment; and as there was 18.53 per cent of this size in the soil, it really contained more plant-food than the clay, and considerably more than its pro rata of these as well as of all the other soluble ingredients of the soil. This condition of things is just contrary to the analysis of the .25 mm. of the humid soil (see Table No. 1), in which there was a less amount than the pro rata; thus showing that while in the humid soil the .25 mm. has very little plant-food, the .25 mm. of the arid has a great deal.

The next sediment, the .50 mm. hydraulic value, which was found to be practically insoluble in the humid soil, has more than its pro rata of soluble matter and of plant-food in the case of the arid soil. With 1.00 per cent of potash, 2.11 per cent of lime, and .34 per cent of phosphoric acid, it still shows an excess, except in the case of lime.

The 1 mm. unfortunately was lost, and there was not time enough to obtain a new lot of sediment. The phosphoric acid, which was determined, was .30 per cent, or still above the amount in the soil. The loss, fortunately, does not greatly affect the results, as the sediments coming before and after show pretty nearly what it would contain.

The 2 mm. comes nearer to the analysis of the soil, although the .86 per cent of potash, 2.87 per cent of lime, and .29 per cent of phosphoric acid is each still in excess of its pro rata; and with over 30 per cent of soluble matter is very different from the 1 mm. of the humid soil, which had only .36 per cent of soluble ingredients.

In the 4 mm., the potash, 76 per cent, is just the same as in the soil, but the 2.55 per cent of lime and .27 per cent of phosphoric acid are higher.

In the 8 mm., for the first time the potash, .52 per cent, is lower than in the soil, this being the case in the 8 mm. sediment from the Tulare soil. The lime was also lower and the phosphoric acid in both sediments higher than in the soils themselves.

In the 16 mm., both the potash and phosphoric acid have taken a decided drop, while the lime has remained about the same.

In the 32 mm., with its .31 per cent of potash, 1.35 per cent of lime, and .13 per cent of phosphoric acid, there has been quite a decrease; but still, even this coarse sediment is richer than the average soils of humid regions in all plant-food ingredients.

In the 64 mm., there is a slight rise of both potash and lime, for some unknown reason.

Coarse Sediments.—Now come some of the most interesting analyses of the whole series to consider, viz., those sediments of 1 mm. and 2 mm. in diameter. These are usually thrown out in all analyses of soils as not containing any plant-food, but the analyses do not strengthen this view.

These sediments were taken from the Tulare soil, as none of the coarse earth of the Pomona soil was to be had. They were first separated by sieves of corresponding diameter-mesh, then thoroughly boiled in distilled water for several hours, freed from the clay by washing, then dried and sifted again. These coarse grains were treated in the way usually pursued in a soil analysis.

The 1 mm. sand had over 5 per cent soluble in acid, and 3.83 per cent soluble in sodium carbonate solution. Then the most remarkable fact appears in the presence of .25 per cent of potash, .53 per cent of lime, and .06 per cent of phosphoric acid, which is as much as many productive soils contain. The presence of so much soluble silica would indicate that this plant-food was there in zeolitic compounds and probably available to plants.

The sand 2 mm. in diameter showed only about 1 per cent less soluble in acid, and 1 per cent less of soluble silica than in the 1 mm. sand. The .15 per cent of potash and .24 per cent of lime and .08 per cent of phosphoric acid are still quite large, and show that even in these coarse grains, now almost gravel, there is considerable plant-food that is available for the plants, and also probably held in zeolitic compounds incrusting the surface of the grains, as indicated by the presence of so much soluble silica in the small soluble portion.

The fact that there is as high an amount of soluble silica in proportion to the part soluble in acid as occurs in any other of the sediments would indicate that the soluble part of these coarse grains is in much the same condition as that of the finer sediments. There seems to be no reason why the grains coarser than 2 mm. diameter should not be in part soluble, although of course in a less degree.

As these grains were thoroughly boiled, it could not be the clay clinging to them, which dissolved; and the microscope shows that, while the grains are tarnished and colored, they are still free from adhering particles of clay, so that the grains themselves must have been dissolved to some extent. The most reasonable explanation, and the one which all of these facts seem to strengthen, is that the surface of the grains is slightly decomposed and that it is this coating which is dissolved by the acid. The appearance of the sediments before and after treatment with acid would hardly admit of any other explanation. Before treatment they are dull; afterward they look clean and almost white; a direct experiment made by taking a number of different colored grains and treating them with acid showed that the loss of color was due entirely to the removal of the coating. All the pieces of yellow mica lost their yellow coating and became of a pearly whiteness.

From the discussion so far, we can say that, in these two soils examined, several things have been shown to exist: (1st) that all the sediments that go to make up the "fine earth" are more or less soluble and contribute somewhat to the plant-food; (2d) that in the Tulare soil, which is in no way a peculiar one, the coarse earth is also soluble to some extent, and the constituents are apparently about the same as in the finer sediments; (3d) that the soluble matter does not decrease as the sediments grow larger any more than might be expected from the decrease in exposed surface; (4th) that the regular decrease in potash and phosphoric acid shows that they are in the same condition in all the sediments, and that the lime is not.

So far, in this discussion, we have presented nothing to show that this theory of a coating of decomposed surface holds true in the sediments examined. A microscopical examination of them, before and after treatment with acid, was made, and revealed a number of things.

The rough and jagged nature of the grains before treatment with acid shows that they could not have been transported any great distance; and from the contour of the country around Chino, there can be but little doubt but that they came from the Sierra Madre Mountains about ten miles to the north.

Their mineralogical character was very complex, as will be noted from the number of minerals identified, viz., muscovite, biotite, orthoclase, plagioclase, calcite, quartz, tourmaline, amphibole, and garnet.

These show two things; viz., that the rocks from which they were derived were very varied, and that water had not had much to do in the formation of the soil, or the feldspars and calcite would not have remained intact. From this mineralogical study a very good idea of the richness of the soil can be obtained and one would know, without making a chemical examination, that it was rich in potash and lime.

Another thing that was shown was that the grains were dull and tarnished; especially was this noted in the coarser grains, and which made them have a dirt-colored appearance before they were digested with acid, but afterward they appeared almost white, and under the microscope looked clean and shining, and a large portion of the colored particles had disappeared.

In the fine sediments a great many of the grains seem to have been broken down. In the .50 mm. for instance, before treatment the grains were regular in size, but afterward there was no longer any regularity, and it was impossible to recognize any of the minerals; everything seemed to be torn to pieces.

In the coarser sediments this was not so, the grains only looking as if they had been through a polishing machine that had taken off every particle of dirt.

In a mixture of grains, the treated and untreated were easily distinguished from each other under the microscope.

It is from these facts that the conclusion is drawn that the grains are covered with a coating which under humid conditions would be in the clay, but in the arid conditions has remained on the surface of the grains.

Other Soils.—So far the discussion has been limited to the two soils of which analyses and examinations were made, and it would be hard to draw any general conclusions from so limited data, but fortunately there has been a good deal of work done which will help to prove that these two cases were not exceptions, but that they pertain to all the arid soils of California.

In order to show this it will be necessary to consider Table No. 3, prepared from mechanical analyses and the acid-soluble parts of a great number of soils of this State found in the report of the California Experiment Stations for 1892–3.

TABLE No. 3—MECHANICAL ANALYSES OF CALIFORNIA SOILS.

Number	Name.	Locality.	Clay	Clay plus Silts.				Sand	Soluble in Acids
				To .25 mm.	To .50 mm.	To 1 mm.	To 2 mm.		
	CLAY LOAMS.								
1645	Alluvial	Kells, Yuba City	15.30	58.8	68.9	77.1	85.4	12.7	32.4%
67	Mining slum	Chinese Camp	18.47	46.7	54.9	65.5	77.5	18.7	27.4
1647	Redwood soil	Guerneville	16.54	37.0	40.4	44.5	51.7	45.2	24.2
1113	Red foothill	Amador	16.43	51.3	61.3	69.0	77.2	20.0	35.3
4	Adobe ridge	University	18.92	41.0	47.8	57.2	63.8	32.1	15.0
168	Valley silt	Santa Paula	15.02	30.2	35.3	43.3	56.0	45.5	11.9
	LOAMS.								
10	Sediment	Sacramento	12.06	55.6	68.7	82.4	92.7	3.5	31.4
1284	Moist land	Chino	13.44	35.5	40.4	46.4	59.9	35.9	28.8
586	Plains	Outside Creek	10.48	34.9	37.1	47.7	53.9	43.3	22.2
1115	Granite	Amador	11.86	32.8	36.1	40.0	45.9	52.2	26.3
51	Red foothill	Auburn	13.91	45.8	51.4	62.8	78.0	14.9	31.6
130	Reddish loam	San Gabriel	10.70	27.3	33.9	39.0	46.1	50.4	19.4
1167	Black land	Tulare	14.65	38.9	44.4	47.9	54.9	42.6	21.2
1055	Red sandy loam	Fresno	11.01	29.9	36.4	44.9	57.6	42.4	20.9
1678	Sandy alkali	Tulare	10.42	45.3	48.1	54.6	62.3	31.5	----
	SANDY LOAMS.								
1281	Mesa	Chino	7.60	26.1	31.6	35.5	41.9	50.8	22.5
1159	Sandy plain	Tulare	5.71	16.7	20.8	26.3	33.4	63.7	20.6
1147	Sandy loam	Paso Robles	7.40	25.2	31.2	39.8	48.2	50.5	9.6
	SANDY SOILS.								
1148	Swale	Paso Robles	3.09	24.6	27.8	38.1	45.9	51.6	10.0
1197	Gila bottom	Gila River	3.21	8.7	10.7	13.9	24.1	72.1	23.0

This table was compiled from table arranged for a comparison of water capacity with mechanical analysis given in Report of California Experiment Stations, 1892–3 and part of 1894.

In this table, only soils that could be considered as typical arid soils were taken.

Now from all the analyses of clays at hand, it is found that they are about one half soluble in acid; the .25 mm. sediments are a little less than one third soluble in acid, the other sediments averaging about one sixth soluble.

Now, as the sum of the sediments make up the soil, so the sum of the soluble parts of the sediments, when referred to the amount of sediment in the soil, ought to make up the soluble part of the soil.

So that if there is only 5 per cent of clay in the soil, and 20 per cent of the soil is acid-soluble, all the soluble part can not be in the clay. If 50 per cent of the soil is of 2 mm. hydraulic value and less, and 20 per cent of the soil is soluble, all of the soluble part can not be in the 50 per cent, because none of the fine sediments are more than one third soluble and most of them only one sixth; so that the other 50 per cent of coarser sediments must be partly soluble in order that the soil could have so high a per cent of soluble matter.

Upon examination of the table, it will be seen that in every case it is impossible for all of the soluble part to be in the clay, even in the clayey soils.

Take, for example, soil No. 1647; 51.7 per cent of the soil is made up of 2 mm. and less, and yet 24 per cent is soluble in acid, or all these sediments would have to be half soluble, which in no case has been found to be so; so that in this case the coarse grains must be soluble. In the case of loam soils this is even more striking, but most so is it shown in the sandy soils. No. 1197, Gila bottom soil, with only 23 per cent soluble in acid, has only 24 per cent of the soil finer than 2 mm., thus showing that a very large part of the soluble matter must be in the 72 per cent of sand; that is, over half of the soluble part of the soil must be in the 4, 8, 16, 32, and 64 mm. sediments.

These facts prove that the results obtained in the Chino and Tulare soils were not accidents and had to do only with those soils; but that they showed general conditions that apply to a great many of the arid soils of this State and in all likelihood to all arid soils of the world.

Conclusions.—From these facts it would seem as if we were justified in concluding that the clay of arid soils is not a very important factor in plant nourishment as compared with the clay of humid soils. That there is a rather general distribution of plant-food through all the sediments, and that this plant-food is in about the same condition in all the sediments, the difference being only in the quantity; and that conclusions that have applied to humid soils will not always apply to arid soils.

The difference also between poor sandy lands of the East and the rich sandy lands of the West is quite easily explained.

Of course a great many more analyses would be desirable in order to be absolutely certain that these cases have not been exceptional, but the evidence as it now stands very much strengthens the conclusion.

INVESTIGATIONS ON THE DETERMINATION AND COMPOSITION OF HUMUS, AND ITS NITRIFICATION.*

By Charles Rimbach.

The investigation on the nitrification of the *matière noire* of Grandeau, here discussed, was undertaken on the suggestion of Professor Hilgard, to test the question whether or not that substance is to be regarded as a source of nitrates under the influence of nitrifying bacteria, as has been assumed but never definitely proved. The method of preparation consists in treating the soil with dilute hydrochloric acid to remove the lime and magnesia with which the humus-substance forms insoluble compounds; and after washing with distilled water, until the filtrate is neutral, extracting it with 6 per cent ammonia. On evaporation the solution leaves the *matière noire* behind.

As a medium containing the carbonates of lime and magnesia is most favorable to nitrifying bacteria, the compound of the humus with these earths was employed for the experiment in order to simplify conditions. For this purpose the ammonia extract from a soil was precipitated with hot solutions of gypsum and magnesium sulfate, the compound, which settles very slowly, was washed and decanted several times with gypsum solution to keep it flocculated, and then put on a linen filter. After the liquid had passed, the mass was further washed by shaking up in a bottle with gypsum solution, this operation being repeated until the filtrate was nearly colorless. The precipitate was dried at 100°, whereby it lost considerably in volume, forming a hard, brilliant, brittle mass with conchoidal fracture. It was free from ready-formed ammonia expellable by magnesia. The lime-magnesia compound thus prepared naturally contained gypsum. In the air-dry condition the precipitates prepared from two different soils had the following composition:

West Berkeley Soil: an excessively stiff clay or "black adobe" soil, rich in lime, containing over 2 per cent of *matière noire.*

Calcium-Magnesium-Humate.	Per Cent.
Water	17.95
Ash	14.34
Organic matter	67.71
Nitrogen	3.06 of the organic matter.

Redwood Soil, from Marin County (sandy humous soil).

Calcium-Magnesium-Humate.	Per Cent.
Water	17.80
Ash	15.37
Organic matter	68.57
Nitrogen	4.01 of the organic matter.

The ash of the latter was soluble in dilute hydrochloric acid, leaving an insignificant white residue. It contained

	Per Cent.
Lime	47.07
Magnesia	13.65
Phosphoric acid	6.15
Potash, in noticeable quantity.	

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* Published in Journal of the American Chemical Society, May, 1900.

The humate from the Redwood soil, being the richer in nitrogen, was used for the nitrification experiment. 28 grams of humate = 22.8816 grams of dry matter with 0.767 grams of nitrogen, was mixed in a beaker with 2 kilograms of sand taken from drifting sand dunes, a short distance from the ocean near San Francisco; it had been previously ignited, and freed from nitrates, by leaching with chlorhydric acid and distilled water.

The material for infection was prepared from soil of the Ten-Acre Tract, Southern California Experiment Station. This soil contains from 1,560 to 12,280 pounds of alkali salts per acre to the depth of one foot; up to 23 per cent of these are nitrates = 0.062 per cent of the soil. After having been freed from nitrates by washing with distilled water, it was shaken with water, the turbid liquid being filtered through linen; with the filtrate the above mixture was moistened.

The material was kept for two months at a temperature of about 25° C. Every other day—with some interruptions—the sand was moistened, so that the content of free water amounted to about 2 per cent, stirred up with a glass rod, and thus kept in a mellow, flocculated condition, to facilitate the access of the air.

After that lapse of time the moistened sand was mixed thoroughly, and a part of it was dried, weighed, and leached with water. The extract, subjected to the colorimetric determination of nitric acid, showed that 5.94 per cent of the nitrogen of the humus-substance had been nitrified.

Further experiments are in progress for comparing the nitrification in a natural soil, and in the same freed from *matière noire*, in which the microscope showed only slightly browned vegetable débris.

Conclusions.—The assumption made heretofore by Professor Hilgard and others, that Grandeau's *matière noire* is a direct source of nitrogen through nitrification, is definitely verified by the above experiment, in which all other possible sources were eliminated. It also justifies, presumptively, Professor Hilgard's thesis that humus containing a high percentage of nitrogen, such as is found in the soils of the arid regions, will yield larger amounts of nitrates in the same time than will that of lower nitrogen-percentages, and that conversely, low nitrogen-percentages may fail to supply a sufficiency for plant growth.

DETERMINATION OF HUMUS.*—An investigation was also made to test the Grandeau method for the determination of humus, and particularly that of nitrogen in humus, as hitherto used. This method is the following:

Two portions of five or ten grams of air-dried soil are weighed off into prepared filters. They are treated with one per cent hydrochloric acid to dissolve out the lime and magnesia, as already explained. The treatment with acid is continued until there is no reaction for lime; the acid is then washed out with water to neutral reaction. The funnels containing the washed soils are now stoppered, and one of them is treated with ammonia water, 6 per cent strong, for the determination of humus by evaporation; and the other with sodic hydrate, 4 per cent strong, for the estimation of nitrogen. The lye, ammonic or sodic, remains in the

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*The word "humus," as used in this paper, is intended to designate Grandeau's *matière noire*.

respective funnels a few hours; the solution is then allowed to pass through and the filter washed once with the lye; the funnel is then restoppered and a fresh quantity of the solvent put on the filter. The treatment is repeated until the filtrate remains colorless. The solutions are then made up to one liter, and aliquot parts are taken for the determinations.

The *ammonia* solution is evaporated in a weighed platinum dish, the residue dried at 100°, weighed, ignited and reweighed; the loss in weight showing the amount of humus.

The *sodic* solution is treated with sulfuric acid and mercuric oxid to determine the nitrogen in the usual way.

The percentage of nitrogen in the sodic extract is referred to the percentage of humus in the soil as determined by ammonia-extraction, for obtaining the percentage of nitrogen in the humus.

It was to be decided whether, as assumed in this method, ammonia and soda extract the same quantities of humus and nitrogen, *i. e.* the same substances. For this purpose two soils (peaty soil from Westminster, Orange County, California, with 19.12 per cent humus, and heavy black adobe soil from the University grounds with 1.20 per cent humus) were treated as above described. A duplicate of the Westminster soil served for determining the quantity of humus lost for the analysis by the extraction with acid and water, which was prolonged until 1 liter of filtrate was obtained. 300 c. c. of this filtrate on evaporation gave 0.0375 grams of residue, containing 0.0367 grams of organic matter with 7.45 per cent nitrogen. This quantity of organic matter is 4.53 per cent of that contained in the ammonia extract.

For determining the organic matter of the ammonia solution, aliquot parts of it were evaporated. The residue always contains combined ammonia, which was determined in another aliquot part (previously boiled to expel free ammonia) by distillation with magnesia. The quantity found, subtracted from the loss of weight by ignition, gives the organic matter. In the residue from the distillation the organic nitrogen was determined by the Kjeldal method.

	Grams.
Residue of 200 c.c. ammonia solution	0.1795
Ash	0.0108
Ash-free ammonia humate	0.1687
Less combined ammonia	0.00834
Organic matter	0.16036

The combined ammonia (taken up from the ammonia solution) amounts to 4.93 per cent of the ash-free ammonia humate, the organic nitrogen to 6.98 per cent of the organic matter.

The determination of the organic nitrogen in the ammonia and soda solutions respectively, when applying the above correction, gave the following results:

	Milligrams.
Organic nitrogen in 100 c.c. ammonia solution	5.33
Organic nitrogen in 100 c.c. soda solution	8.23

These results are important, in that they prove that soda solution extracts more nitrogen than does ammonia.

On account of the impossibility of determining the organic matter in the neutralized soda solution by evaporation and calcination, because of the large quantity of sodium salt, which hinders the combustion, it was decided to determine by the precipitation of the humus the quantity and quality of humus-substances in both extracts. In order to determine which reagent precipitates the humus most completely, ammonia-humate extract from University adobe soil was treated with solutions of copper and magnesium sulfates, and with hydrochloric acid. Before adding the salt solutions, the humus extract was freed from uncombined ammonia by boiling; the precipitates were washed with boiling water, in which the magnesium humate was rather soluble, while the filtrate from the copper humate was perfectly clear and nearly colorless. The hydrochloric precipitates were washed with 2 per cent hydrochloric acid until 500.00 had passed. All precipitates were free from ammonia. The nitrogen content of the filters was considered. For all precipitations the same quantity of ammonia extract was used.

Precipitants Used.	Organic matter of the precipitates in per cents of the total organic matter of the extracts.	Nitrogen of the Precipitates.		Ash in per cents of the precipitates.
		In per cents of the organic matter of the precipitates.	In per cents of the total organic nitrogen of the extract.	
Copper sulfate	89.16	----	-----	23.40
Magnesium sulfate	65.24	4.48	-----	14.60
Hydrochloric acid	85.21	4.93	88.24	5.21

These results show that magnesium sulfate (because of the solubility of magnesium humates in water) is not suitable as a precipitant, while copper sulfate precipitates the humus-substances most completely. Hydrochloric acid has nearly as complete an effect as copper sulfate, and as it can be added to the extract without previous elimination of ready-formed ammonia, it was used for the determinations described above.

The precipitation of the humus with hydrochloric acid in the ammonic and sodic extracts from the Westminster and the University soils gave the following results:

	Precipitate of the humus acids by HCl. grms.	Organic matter of the same—grms.	Nitrogen of the Precipitates.	
			In per cents of the organic matter of the precipitates.	In per cents of the total organic nitrogen of the extract.
Westminster soil—				
Ammonia solution, 200 c.c.	0.1127	0.1120	5.84	54.78
Soda solution, 200 c.c.	0.1495	0.1490	3.75	22.78
University soil—				
Ammonia solution, 300 c.c.	0.0299	0.0233		
Soda solution, 300 c.c.	0.0103	0.0077		

It is thus seen that the humus substances of these two soils behave altogether differently toward ammonic and sodic hydrates as solvents.

The nitrogen of these precipitates was not determined on account of the small amounts obtained. The organic matter of the hydrochloric precipitate from the Westminster ammonia-solution is 70.24 per cent of the total quantity of organic matter contained in the same.

Even if the chlorids of ammonium and sodium should influence differently the solubility of the precipitates, the ratio of the latter, which is 3:4 in the first and 3:1 in the second case, shows that substances of different nature are thus obtained.

Organic Matter in the Soda Extract.—For determining approximately the ratio of nitrogen and organic matter in the soda extract, a weaker solution, which of course may have a different solvent power, was used in the extraction. 140 grams of University adobe soil, after being extracted with hydrochloric acid and water (250 c.c. of the latter contained 0.0133 gram of organic matter), was treated during twelve hours with 1 per cent soda solution, then washed with ¼ per cent soda lye; this operation being repeated until 1 liter of filtrate was reached. 50 c.c. of this was evaporated, the residue ignited, a solution of ammonium carbonate added in order to convert lime and magnesia into insoluble carbonates, evaporated again, and the residue gently heated. Then the ash was extracted with water and the quantity of sulfuric acid necessary for neutralizing the soda determined by titration. With the same quantity of acid 50 c.c. of the soda solution was evaporated. The residue dried, weighed, ignited, and reweighed showed the organic matter. The determination of nitrogen was made with an aliquot part.

For comparison, 140 grams of the same soil was treated with the same quantities of acid-water and 6 per cent ammonia, and the extract was analyzed in the usual way. The ash-free residue contained 5.88 per cent of ready-formed ammonia.

	Organic matter.	Organic nitrogen in per cents of the organic matter.
Ammonia solution, 50 c.c.	0.0589	4.73
Soda solution, 50 c.c.	0.0543	5.37

These figures, however, do not allow a definite conclusion as to the total amount of soluble humic matter in the soil. For it was found that in the ammonia filtrates obtained at different times during the extraction (which lasted six days), the nitrogen percentages of the organic matter vary considerably. The differences in the percentages of combined, ready-formed ammonia are small.

Ammonia Solution from Soil from the Ten-Acre Tract, Chino.	Organic nitrogen in per cents of the organic matter contained in the solutions.	Combined ammonia in per cents of the ash-free ammonia humates.
Filtrate from the first four hours	4.90	6.75
Filtrate from the seventh and eighth day	9.35	7.26

Apparently the humus-substances that are poor in nitrogen are readily soluble in ammonia, and consequently form the main part of the first extract; while the substances with higher nitrogen-percentages are less soluble and need a longer time for entire extraction by ammonia, but are more quickly dissolved by soda.

Conclusions—1. By leaching with chlorhydric acid and water, a certain quantity of humus, varying in the different soils, is lost to the subsequent extraction with ammonia.

2. The content of nitrogen of the soda extract, being different from that of the ammonia extract, can not be directly referred to the content of organic matter of the latter.

3. In the determination of organic matter and nitrogen in the ammonia extract, the quantity of combined ammonia must be considered, as has been described in the analysis of Westminster humus.

It is thus evident that the *percentages of humus* heretofore determined are too high, inasmuch as the combined ammonia, which is about five per cent of the ash-free ammonium humate, has been erroneously calculated as organic matter. Furthermore, if all soils behave like the Westminster soil, from which soda extracts about one and a half as much nitrogen as does ammonia, the *nitrogen-percentages* in humus as heretofore determined, even though they are referred to organic matter and combined ammonia, would be too high.

4. The question still remains whether sodic or ammonic solution, and in what strength, satisfy best the requirements of a solvent for humus-substance, regarded as the sum of organic substances, decomposed or not, that are immediately available for the plants.

After concluding this investigation, we received a publication of A. L. Emery entitled "Soil Humus. Some Sources of Error in Analytical Methods." As to the absorption of ammonia by the humus solution, there mentioned, it is, as we have explained, at least partially a simple process of combination of the humus acids (liberated by hydrochloric acid from earth bases) with the ammonia; the quantity of the latter has been regularly determined by Professor Hilgard for some time past, by distillation with magnesia (*not* lime, which decomposes organic nitrogen compounds). A question, however, still to be decided is whether or not the ammonia used forms amido-compounds with the humus-substances during the digestion or evaporation.

NATURE, VALUE, AND UTILIZATION OF ALKALI LANDS.

(Bulletin No. 128.)

In March, 1900, a bulletin on the above, prepared by Prof. E. W. Hilgard, was issued by the Station, in response to a pressing demand for information on the subject of alkali. It treats of the occurrence and characteristics of alkali soils, the distribution of alkali salts in the soil, injuries produced by alkali, the effects of irrigation on the rise of alkali, and the utilization and reclamation of alkali lands; methods of removing the salts from the soil, of counteracting evaporation, and effect of stable manure and other fertilizers; crops suitable for alkali lands, amount of salts compatible with ordinary crops; irrigation with saline waters. A chapter in the bulletin treats of natural vegetation as used to distinguish reclaimable and irreclaimable lands, and the relative tolerance of these alkali plants. The bulletin is illustrated with engravings. As there is an ample supply on hand for distribution, it is not reprinted here.

2. WATERS.

The chemical examination of waters of the State, sent in by private individuals, still occupies a large part of the time of the Station chemists, very much to the detriment of other lines of investigation. The larger part is, however, of utmost importance to the farming communities where used for irrigation purposes, for in many instances we have found the water so highly charged with alkali as to make its use on the land dangerous to vegetation.

Since the issuance of the last annual report, 1898 to June, 1901, there have been received and examined more than 310 samples of waters from many parts of the State, to ascertain their adaptability for either domestic or irrigation purposes. This large increase of samples per year above what had previously been the average is not a matter of surprise, for the low rainfall of the past few years has driven farmers to the use of irrigation water upon their lands; and in the search for new supplies the now generally recognized danger of alkali accumulation from the use of water charged with alkali has caused the many requests for examination. This is also emphasized by the fact that 45 per cent of the samples have come from the seven counties comprising the southern part of the State, and 16 per cent from the San Joaquin Valley—the two irrigating regions of the State; 17 per cent came from the counties of the Bay region.

Forty-three counties were represented by the samples; of these, Los Angeles sent 33 samples; San Diego, 30; Ventura, 22; while Riverside and Alameda sent 20 each.

The samples grouped in their natural divisions comprised the following: 20 samples from lakes and streams, 67 from springs, 181 from common and bored wells, 19 from artesian or flowing wells, and 24 from reservoirs and irrigation ditches.

In reviewing the tables of analyses we find that 52 per cent of the waters sent for examination are unfit for use because of the large amount of soluble alkali salts they contain. Taken according to their natural divisions, we find the following percentages of unsuitable waters:

	Per Cent.
Lake and stream waters	70.0
Spring waters	56.0
Common well waters	56.7
Reservoir and ditch waters	47.8
Artesian well waters	31.6

It would thus appear that the purest waters for both domestic and irrigation purposes come from artesian wells which penetrate far below danger of contamination with the alkali salts that occur in the soil strata near the surface; and that the most impure waters examined are those of lakes and streams, though of course there are streams flowing from the Sierras whose waters are among the purest in the State.

The samples from ordinary wells comprise 58 per cent of the whole number, and the examinations show the following average composition according to regional divisions:

	Numberof Samples.	Total Salts.	Glauber Salt.	Common Salt.	Sal Soda.
Foothills	8	32	8.6	11.8	3.2
Sacramento Valley	16	47	5.2	32.0	1.5
San Joaquin Valley	27	136	34.9	39.5	7.6
Coast Range	53	77	18.3	25.1	2.6
Southern California	77	87	37.1	24.2	2.3

Thus, the San Joaquin Valley is seen to have in its wells the largest amount or average of total mineral matter and of soluble salts. Its waters contain larger averages of common salt and sal soda, the former being the predominating constituent.

Southern California comes next with the highest total mineral matter and alkali salts. In its waters, however, glauber salt is the chief constituent; its common salt is below that of each of the other regions except the foothill, and its carbonate below each except the Sacramento Valley.

Sacramento Valley ranks as fourth in total salts, second in common salt, and lowest in glauber salt and carbonate of soda.

The Coast Range is third in total mineral matter and also in each of the soluble constituents.

The foothills are lowest in total mineral matter, but contain more glauber salt than the Sacramento Valley and more carbonate than the Coast Range or Southern California. There was, however, but one water from the foothills whose alkali salts rendered it unsuitable for use; and it happens that the amount in this one water was so large that it raises the general average above that of the Sacramento Valley in total mineral matter and above that of the Coast Range and Southern California in carbonates. The region should naturally be lowest in the whole series, as shown by the averages if this Rocklin well were omitted.

The details of these analyses will be given in Part II of this report.

3. FOODS, FEEDING-STUFFS, AND FERTILIZERS.

By M. E. Jaffa.

The chemical analyses of foods, food materials, dairy products, etc., undertaken during the last two years, are briefly outlined below. The results will be given in a future report.

FOODS AND FOOD MATERIALS.

Green Fodders, Silage, etc.—Three analyses were made of "pie-melon" or citron-melon, ten of silage from cereal crops, two of sugar-beet pulp silage, and one of marsh grass.

Hays, Coarse Fodders, etc.—Four samples of saltbush hay were examined, two of cereal hay, one each of lima bean straw, alkali weed, and gourd vine.

Miscellaneous.—The food value was determined of olive pomace, two samples of dried blood, two of meat meal, and two of oil cake meals.

Grains and Mill By-Products.—Analyses were undertaken of four samples of wheat bran, five of middlings, two of wheat, one each of barley, broom corn, rice, rice hulls, and wheat screenings, and three specimens of gluten flour.

DAIRY PRODUCTS.

Milk.—Twenty-nine samples of milk were examined, all of which were fully up to the standard for fat, and found to be free from adulteration.

The result of an examination of skim-milk showed the fat content to be 0.3 per cent.

Cream.—Analyses were made of seven samples of cream. The minimum percentage of fat found was 24, and the maximum, 44.

Condensed Milk.—The examination of condensed milks comprised the analyses of seven samples of California and Eastern manufacture, and also the investigation of some diseased milks.

Butters.—A study was undertaken of six samples of butter, made from milk secreted by cows largely fed on sugar-beet pulp silage.

FERTILIZERS.

Gypsum.—Thirteen samples of this material were examined; the purity varying from 40.59 per cent to 99.89 per cent.

Complete Fertilizers.—Seven analyses of complete fertilizers were made, all of which were found to be fully up to the manufacture's guarantee.

Special Fertilizers, Miscellaneous, etc.—Examinations were made of four samples of special fertilizers, two of bat guano, one each of sheep manure, meat meal, olive pomace, and peat.

FOOD VALUE OF PIE-MELONS.

One of the chief requisities of a ration for profitable milk-production is that it be succulent, by which is meant that a portion of the ration contains a large percentage of water. This watery condition, or succulency, adds to the palatability of the food, and also seems to have a beneficial physical effect upon the animal digestion. The cow, therefore, eats a larger quantity of food, digests and assimilates it more thoroughly, and consequently gives a larger flow of milk. Although the major portion of California does not have the long cold winters to which the Eastern States are subject, and where it is an absolute necessity to store large quantities of food, both succulent and dry, still every section of our State has a longer or shorter period during the year when pastures are dry. The provident dairyman, therefore, anticipates these dry months, and either lays in a store of green food beforehand, or has some growing which he may cut and feed to his cattle.

Pie-Melon.—A class of vegetables which is useful and easily grown is that of the melons and squashes. A very familiar example is the so-called *pie-melon*, an analysis of which is found in Table I.

The pie-melon is a much more watery food than any of the others named in the tables; the water percentage in one case reads as high as 95, while the corresponding figure for sugar-beets is 84, and there are many cases where the amount of water in sugar-beets will be even less than that given in the table, on account of the sugar percentage ranging higher than 12. The average for sugar in the analyses of sugar-beets, as given in Professor Henry's late work, is only 9.8. Twelve per cent of sugar, starch, etc., in sugar-beets is a very conservative estimate for this State.

TABLE I—Analyses of Pie-Melons.

Percentage Composition.

	Flesh and Rind.	Flesh and Rind.	Average Flesh and Rind.	Seeds.	Average Flesh and Rind with Seeds.
Moisture	94.00	95.00	94.50	45.00	93.55
Pure ash	.43	.37	.40	1.53	.42
Crude protein	.83	.71	.77	11.73	.97
Crude fiber	1.38	1.08	1.23	18.11	1.56
Starch, etc.	3.13	2.62	2.88	18.20	3.18
Crude fat	.23	.22	.22	5.43	.32
Total	100.00	100.00	100.00	100.00	100.00
Amount Digestible in 100 Pounds.					
Protein	.62	.53	.58	10.56	.73
Fiber	1.04	.81	.93	10.87	1.17
Starch, etc.	2.97	1.99	2.48	10.92	2.81
Fat	.20	.19	.20	4.34	.26
Nutritive ratio	1:7.2	1:4.2	1:6.6	1:3.0	1:6.3
Fuel value (calories in one pound)	94	70	82	784	98

Roots.—Several of the vegetables are valuable in supplying succulence for the ration. Among the root class the one in most common use is the mangel-wurzel beet, because very large quantities can be grown per acre, and because it is palatable to all kinds of live stock. Carrots are also used in some sections, and they have the advantage of containing a slightly larger amount of dry matter than mangels. Of all the roots, moreover, none are more relished by horses than carrots. Sugar-beets are not found profitable to grow for feeding stock, because they yield so small a tonnage in comparison to mangels, and the greater cost of growing and gathering can only be undertaken on the ground of their greater value for sugar. Potatoes contain about twice as much dry matter as mangels and three times as much carbonaceous material. They are, therefore, of greater food value, but, like sugar-beets, have too high a commercial value as human food to make them profitable for stock.

TABLE II—COMPOSITION OF MANGELS, SUGAR-BEETS, AND PUMPKINS.

Percentage Composition.

	Pumpkins.	Mangels.	Sugar-Beets.
Water	90.90	90.90	84.30
Pure ash	.50	1.10	.90
Protein	1.30	1.40	1.80
Crude fiber	1.70	.90	.90
Sugar, starch, etc.	5.20	5.50	12.00
Fat	.40	.20	.10
Total	100.00	100.00	100.00

Amount Digestible in 100 Pounds.

	Pumpkins.	Mangels.	Sugar-Beets.
Protein	1.20	1.10	1.60
Fiber	1.10	.50	.50
Sugar, starch, etc.	2.90	4.20	11.40
Fat	.30	.10	.10
Fuel value in one pound (calories)	109	113	255
Nutritive ratio	1:4.0	1:4.5	1:7.0

Protein.—The sugar-beet is fully twice as rich in digestible nitrogenous matter, or flesh-formers, as indicated by the protein per cent, as is the pie-melon, the respective averages being for the amounts digestible per 100 pounds 1.6 and .73.

Both the mangels and pumpkins also range much higher than the pie-melon in this important nutrient.

Carbohydrates, Starch, etc.—The percentage of digestible starchy matter, or heat-producing elements of the food, in the sugar-beet is 11.4, while for the pie-melon we find only 2.8—a very wide difference.

The comparative total food values of the pie-melon and the sugar-beet are seen by referring to the figures for the fuel value per pound as expressed in calories. For the sugar-beet we have 255 calories and for the pie-melon entire, 98.

The distribution of the nutrients in the two foods in question is in about the same proportion. This is proved by the nutritive ratios (expressing the relation of the digestible protein to that of the remaining digestible ingredients) 1:6.3 and 1:7.0.

We must not forget, though, that while the sugar-beet is, weight for weight, a much richer food than the pie-melon, yet the yield per acre of the latter may be so far ahead of the former that the net results per dry matter per acre would not materially differ. And certainly the planting and subsequent care and harvesting of the sugar-beet are attended with more trouble than is necessary for the pie-melon.

Again, we must bear in mind that the chemical composition of a fodder should not be our only guide regarding its value as a food. For instance, no one will deny that there is more nutrient, as shown by analyses, in hay than in the beet or pie-melon, still we know practically that better results will attend the feeding of a mixture of hay and pie-melons than hay alone.

The succulency of the pie-melon increases its nutritive value far beyond the rating which is given to it on the basis of the chemical analysis.

While we are fully conversant with the value, chemically, of the pie-melon, we are not familiar with its physiological action. When we are we shall be able to more intelligently discuss the nutritive values of such materials as pie-melons.

REPORT ON A STANDARD EMERGENCY RATION.

The emergency ration consists of three tablets, each measuring 4⅛ inches long by 2⅞ inches wide and ¾ inch thick, with an average weight of 142 grams, or about 5 ounces; a tablet of sweetened tea and small boxes of salt and pepper, all packed neatly and hermetically sealed in a tin box 4½ inches long, 3 inches wide, and 2¼ inches high.

A five days' practical test of this ration has just been completed by J. E. R., a student of the University, who, in addition to his mental work, labors physically, daily, from 5 to 7 A. M. and from 4 to 6 P. M.

The experiment began with breakfast Sunday, January 27, 1901, and ended with supper Thursday, January 31st. One tablet was consumed at each meal.

During this time the subject attended to his accustomed duties, mental and physical.

His weight at the beginning of the experiment was 166 pounds, and at the conclusion 162 pounds, showing a loss of four pounds in the five days' trial.

Summarizing the results of the test, we have:

First—That the ration supplies ample bulk, if cooked according to directions;

Second—While the bulk was sufficient for each meal, there did not seem to be sufficient nourishment in it to sustain the subject from one meal to another;

Third—He experienced an "all gone" sensation in the morning, became hungry before his accustomed meal time, and had less endurance during the day. He also lost weight;

Fourth—During drill hour he reported himself as feeling weak and unfit to skirmish.

Fifth—The subject was not able to do his daily physical work without suffering from fatigue not ordinarily noticed, and also complained of soreness of muscles after exercising;

Sixth—The tablets are palatable, but the lack of variety is soon noticed. The different methods of cooking do not remedy this defect;

Seventh—The subject experienced a constant chilly feeling, which, taken in connection with the "all gone" sensation in the morning, weakness and intense hunger before meals, showed a condition of lowered vitality.

Chemical Examination.—The chemical analysis of these tablets shows their percentage composition to be as follows:

Water	6.95
Ash (mineral matter)	3.55
Protein (muscle-forming elements)	31.50
Ether extract (fat, etc.)	20.30
Carbohydrates (starch, etc.)	36.75
Fiber	.95
	100.00

Calculating, with the aid of these figures, the amount of nutriment furnished by the ration, we have:

	Grams or	Ounces.
Protein	134	4.7
Fat	86.5	3.1
Carbohydrates	163.3	5.8
Calories-energy	2023	

These figures indicate that the tablets do not constitute a balanced ration, in that the carbohydrate content is too low in proportion to the protein.

In order to ascertain if the actual *quantity* of food is sufficient, even if the materials are not in the proper proportions, we must compare this ration with the tentatively adopted standards of Atwater, shown below:

		Protein.	Fat.	Carbohydrates.	Energy.
		Ounces.	*Ounces.*	*Ounces.*	*Calories.*
1. Man at moderate muscular work	Standards	4.5	4.5	15.8	3500
2. Man at active muscular work		5.3	5.3	17.6	4000
3. Man at severe muscular work		6.3	8.8	18.9	5700
4. Emergency ration tablets, shown above		4.7	3.1	5.8	2023

This table proves to us at a glance that while the protein is a trifle higher than that required for a man at moderate work, the fat and carbohydrates are decidedly lower, and the caloric value, which means the heat or energy-producing value of the ration, falls far below the standard. It is too low, even when we compare it with the standard for a man at moderate work. But the men for whom this food was specially designed are certainly doing active, if not severe work, and therefore would require even more nourishment. This could not be accomplished by increasing the size or number of the tablets for a day's ration, for the protein and carbohydrates would only be increased equally and would still be out of proportion to each other.

To make an ideal tablet from the scientific standpoint it would be necessary to increase the fat and carbohydrates first, and then put a larger quantity of this new mixture in each tablet.

The deficiency of carbohydrates and fat is a serious defect in an emergency ration, for these ingredients are preëminently heat or energy-producing elements of the food.

While it is true that protein (the muscle-forming element) can be used as fuel in emergencies, it is a more elaborate and difficult process for the human system, and it is more than likely that the fat of the body would be broken down and used for that purpose, rather than the protein, which is essentially a muscle-builder. It is especially necessary, in times of strain, that the system receive its full supply in the easiest way, and this is by means of fat and carbohydrates.

The deficiency as shown by the foregoing, intelligently explains the defects noted in the practical test.

The emergency ration is a great invention and a boon to certain classes of men who are obliged to carry their food with them. The tablets, however, should not be used as a convenience in their present form, but only under great stress of circumstances.

PLUMP VS. SHRUNKEN WHEAT AS FOOD FOR LAYING HENS.

The question as to which is the better food for laying hens, shrunken or plump wheat, is one which has been agitating a number of poultrymen in this State, and to intelligently answer it two samples of wheat, received from Mr. Macfarlane, of Hanford, have been analyzed, with the following results:

	No. 138. "Shrunken."	No. 139. "Plump."
Moisture	8.30%	9.80%
Ash	2.34	2.00
Protein	17.10	11.70
Fiber	3.48	2.05
Starch, etc.	66.78	72.65
Fat	2.00	1.80
Total	100.00%	100.00%
Fuel value in one pound (calories)	1709	1683

Poultry rations are usually too carbonaceous; that is, they contain too much starchy matter and not enough of the albuminoids so necessary for egg production. Consequently, the richer a food is in albuminoids the more valuable it is to the poultry-feeder.

An examination of the above table shows two main differences in the results. In the plump wheat the percentage of starch, etc., is considerably higher than the corresponding figure for the shrunken wheat; while the reverse is noted for the rating of protein, that of the latter sample being almost 50 per cent greater than that yielded by the former, as is seen by the figures 17.10 and 11.70 per cent, respectively. This fact alone is sufficient to warrant a feeder purchasing shrunken in place of plump wheat as a food for laying hens.

It is barely possible that the digestion coefficient for protein in the shrunken wheat may not be as high as that for the plump, but this question we will settle at the earliest opportunity by a digestion experiment with our hens. It must not be forgotten, however, that the figure 11.70 for albuminoids in the plump wheat is a trifle below the average; and while another examination of two similar wheats would in all probability show the shrunken sample richer in nitrogen, there might not be such a marked difference as we have between the two lots under discussion.

4. FRUITS, NUTS, AND INSECTICIDES.

By George E. Colby.

The following is a partial summary of the examinations made in this laboratory during the period covered by this report, from June, 1898, to June, 1901. The results will appear in Part II of this report:

HORTICULTURAL PRODUCTS.

Navel oranges from northern, central, and southern California, with a view of determining the progress of ripening in the several citrus regions of the State; 23 samples.

Summary of examination of *olives:* 800 analyses, 150 of which have not been published, showing adaptation of varieties.

Waste materials of orchards: 23 analyses of grape pomace, orange culls, ashes, etc.

Composition of fruits: 15 samples of Smyrna figs from Fresno; 25 samples of plums and prunes; 58 of wines and grape juices.

Miscellaneous: 20 samples of oils; many waters; hops and hop canes, showing soil ingredients withdrawn by them; 29 samples of cañaigre, and 18 of black wattle; bleaching solution for nuts.

INSECTICIDES.

Paris green and its substitutes; 135 samples.

Crude petroleum distillates for spraying; 10 samples.

INSTANTANEOUS BLEACHING LIQUID FOR NUTS.

Inquiries were received in 1899 and earlier by this Station concerning the status and value of different bleaching solutions on sale generally in walnut-growing districts. Holders of these formulæ claimed that the secret might be obtained for $800, and finally fell in price to $25. This great variation in price put many on their guard, and they turned to the Station for a quick-acting solution which would answer as well as any of those offered for sale, or which would do as well as those for which exclusive rights were claimed or held or said to be held by virtue of a patent.

This Station had already in Bulletin No. 113, issued in 1896, and previously, recommended a bleaching solution for nuts which was in fact, except in the instantaneousness of action, the same as those generally offered in California as patentable formulæ. So far as we have been able to ascertain, all of these formulæ have as a basis Labarraque's solution, now more than a half century old, composed of hypochlorite of soda made from commercial bleaching powder and sal soda.

The only difference between these solutions and the older ones called dips, recommended by this Station, lies in the use of *vinegar* to hasten the operation of "burning" off the stains. The older dips act in about five minutes, are not wasteful of chlorine and oxygen gases, and never evolve them to such an extent that the process becomes obnoxious to the operator. Moreover, the use of vinegar and other acids for this purpose has been familiar for more than half a century and is not patentable.

The enormous crops of the last few seasons have of course made it necessary to provide rapid-acting solutions, in order that great numbers of carloads of nuts may, for obvious reasons, be simultaneously brought into marketable condition.

The walnut crop of a district or county is usually gathered by some firm engaged in the work of preparing fruits for market, or by an association of growers at some point where these operations may be uniformly and profitably carried out; and to these, "hurry-up" methods appeal very strongly.

Tests of Bleaching Solutions Prepared in the Laboratory of the Station.—Three tests of bleaching solutions were made in the laboratory as described below, all upon *walnut culls two years old.* The stains and markings on these nuts were dried, hard, and more fixed in character than those ordinarily carried by nuts fresh from the orchard. These culls therefore represented the severest condition under which any solution might be expected to act, and the results of a few trials were all that were necessary to decide the main questions of the investigation, viz., to make and offer a formula for a practical bleaching solution or dip which is instantaneous in action, and easy to handle, and at the same time may be cheaply prepared.

Experiment No. 1. This experiment is the same as that given in Bulletin No. 113 of this Station, modified by the use of a little acid. The components were

Chlorid of lime or ordinary bleaching powder	6 pounds.
Sal soda	12 pounds.
Water	50 gallons.

The culls treated with this alone for five minutes were pronounced acceptable and a salable article by a representative of the Deciduous-Fruit Association of Anaheim.

Another lot of the culls was treated for from five to ten seconds with the solution aided by dilute sulfuric acid (.15 per cent of acid in 50 gallons of water); after washing with water the nuts came out clean and not injured in the least, and met the approval of the Association.

Another lot of the culls was given the same treatment as above, with the addition of dilute acetic acid (at the rate of .22 per cent of acetic acid in 50 gallons of water). The result was satisfactory and the nuts were not injured; the meat was clean, no taste of the acid at completion of the test, and there was no development of rancidity in the perfect shell nuts after standing a month.

Experiment No. 2. In this solution there were used:

Bleaching powder	25 pounds.
Sal soda	18 pounds.
Water	50 gallons.

The culls were treated for five minutes without the aid of other acids, and gave good clean nuts.

Another lot of culls was treated for from five to ten seconds with the solution, to which was added dilute sulfuric acid at the rate of .15 per cent in 50 gallons of water. The result was satisfactory and yielded salable nuts.

Another lot was treated with the solution, to which was added dilute acetic acid in the proportion of .22 per cent in 50 gallons of water. The result was good and the nuts were not injured, neither was there developed any rancidity at any time after the treatment.

Experiment No. 3. The comparatively cheap *bisulfite of calcium* made up in a 1 per cent solution was used on the culls for five minutes, but failed to remove the stains. The addition of a little dilute sulfuric acid also failed.

Limit in the Action of these Bleaching Liquors.—The drained-off liquors of either of the modified formulas Nos. 1 and 2 gave very satisfactory results when used with successive lots of fresh culls when fresh sulfuric acid was added to the solution. In the laboratory we have obtained as many as four successive well-bleached lots from the original liquid, thus showing that it possessed strong bleaching properties after having performed a great deal of work. This is the reason that it is recommended, farther on in this report, that they be used over and over again till completely exhausted or worked out; this will be shown by a failure to evolve offensive chlorine gas when fresh sulfuric acid is poured into the dipping-tank.

Substitution of Sulfuric Acid for Vinegar.—Obviously, the reason for employing sulfuric acid instead of vinegar in connection with bleaching liquids lies in the fact that, being of a greater and more definite strength than vinegar, it goes much farther, volume for volume, in the process. The bulk of the bleaching liquid is little altered by the necessary sulfuric acid, while the more dilute, indefinite, and weaker vinegar changes the strength of the solution, thus causing its earlier replacement by fresh quantities of the stock liquor.

Formula and Directions for Bleaching Nuts.—A few practical tests, based upon the above experiments, have shown that the following formula and directions for bleaching nuts by the new instantaneous bleaching liquid is satisfactory and leaves nothing to be desired for commercial operations:

Sal soda	12 pounds.
Chlorid of lime	12 pounds.
Water	45 gallons.

Make a paste of chlorid of lime, and dissolve the sal soda in hot water; then put in barrel with 45 gallons of water and mix thoroughly.

Let it stand forty-eight hours, and draw off with wooden faucet placed four inches above the bottom of the barrel. Next dilute 1¼ pounds of sulfuric acid (43° B.) with five gallons of water, in an earthen jar. In a dipping tank, holding 20 gallons, put 15 gallons of the lime and soda solution and add a small quantity, a dipper full, of the dilute sulfuric acid, adding more of the solution and of the acid as it is needed. This tank must be emptied from time to time; twice a day will do for clean nuts. Dip the nuts ten seconds. By having proper drainboards to save the bleaching solution, it is found that four to five tons of walnuts can be bleached with 50 gallons. Wash the nuts with water after dipping them in the bleaching solution. Use wooden or wicker baskets, *not iron* dipping buckets.

Mr. J. D. Neff, president of the Deciduous-Fruit Association of Anaheim, says in the "Rural Press" of January 6, 1900: "All ordinary stains will be removed, but sun-burned and diseased nuts will not be bleached. These must be picked out of the trays by hand. The color will be the natural color of the nuts, and all will be bleached alike if care is taken to keep the mixture of proper strength and the walnuts immersed the same length of time. In order to prevent the waste of the mixture and to get the best results, the walnuts should be all washed as they come from the orchard. This can be cheaply and easily done in a rolling screen made of three-fourths inch wire netting four feet long and two feet in diameter. This should have a piece of pipe over the screen perforated with one-eighth inch holes, four inches apart, and connected by a hose to a tank so as to have a steady supply of water. This kind of screen will hold about 100 pounds of walnuts at each washing. The time required for the operation is usually very short, but can be determined by the appearance of the water as it is run off. The cost of materials for bleaching is about 40 cents per ton, and the cost of handling is about the same as when sulfur is used. This latter cost depends greatly on the facilities at hand and the quantity of walnuts to be handled."

Chemistry of the Bleaching Solution.—The mixture described above is perfectly harmless and can not injure the walnuts in any way. By mixing solutions of bleaching powder and sal soda there are formed carbonate of lime (the white substance which settles to the bottom of the barrel and is discarded), and the water-soluble compounds sodium hypochlorite and chlorid of sodium (common salt).

Insoluble. Soluble in water.
Chlorid of lime + carbonate of soda = lime carbonate + sodium hypochlorite + common salt

The clear liquor then contains two sodium salts, and when sulfuric acid is added to it the acid disappears or is converted into glauber salt and water. Even the identity of the acid is forever gone, as the last washing of the nuts takes away the glauber salt, and there is never again any form of sulfuric acid on the nuts.

Sodium hypochlorite + sulfuric acid = glauber salt + chlorine + oxygen + water

Nothing but wood or earthenware must be used in handling the mixture, for iron vessels or trays will stain the nuts again in such way that they will be permanently discolored.

The following letter of Professor Hilgard is the general answer sent to those companies or individuals who make statements embodying in them claims of inventing the process described above, or the right to charge the public for any similar bleaching formula, or for attempting to use the same on nuts:

> Nothing stated therein can do away with the simple statement that the application of the chlorine bleaching process to nuts was my invention and not Mr. Farrall's, and that it was published in August, 1896, for the public benefit. With it went the right of the public to use any of the old, well-established modifications of chlorine bleaching, such as the addition of acids at any time the user might desire to hasten the process. Although this was not mentioned in our publication, it was actually done in this laboratory, but on the small scale on which we experimented it did not seem to offer any advantages over a somewhat longer treatment with the simple solution. If in operations on the large scale such an advantage appeared, it could not form the basis of any legitimate patent on a process fifty years old at least.
>
> The Assistant Commissioner's ruling will not stand for a moment in a court passing upon the merits of the case. The first claim as set forth in Mr. F.'s patent looks like an attempt to stultify the Patent Office; it is worded almost verbatim like the prescription given as far back as 1837. The Assistant Commissioner, in omitting all reference to our Bulletin 113, ignores the fundamental fact that I originated the use of chlorine-bleaching nuts, and assigns the credit therefor to the patentee.
>
> I can not consent to this attempt to exploit for private gain an idea freely given to the public by this Station; and I shall do all I can to maintain for the nut-growers the free use of whatever is involved in the well-known processes of bleaching with the hypochlorite solutions, in all their modifications.

It is a significant fact that, when the above letter has once been seen by the representatives of companies claiming the invention and the right to collect charges from those using the formula, they never present themselves to him again and apparently give up the idea of trying to sell or collect upon a "*secret formula*" of this description.

Summary.—1. The application of the old-established chlorine-bleaching processes are not patentable, because the process was published in August, 1896, by this Station for the benefit of the public.

2. The difference between the bleaching liquid or dip of this State and those elsewhere offered lies in the simple fact that the loosely combined chlorine of the older ones is set free by the use of vinegar in the newer processes. A five-minute-acting dip is thus converted into a five-second one; and the reason for such quick-acting solutions lies in the necessity for getting many carloads of nuts into marketable shape at or about one time. But the use of vinegar itself is a quarter of a century old.

3. The tests made in the laboratory of this Station showed that a mineral acid could with perfect safety be used in place of the vinegar, which is a weak vegetable one; that *less* of the mineral acid gave excellent results, thus preventing the weakening of the solution.

4. The *limit* of the usefulness of the quick bleaching solutions was, approximately, fixed, even when used upon *culls* on which the stains had dried for over two years—good results were obtained when the solution was used as many as four times.

5. The advantages or gains to be had from the use of the new dip have been shown in practice to be due to the great *saving of time;* the newer "dip" taking only from one thirtieth to one sixtieth the time required for the same work by the older ones. Further, by extending the use of this new dip by saving it and applying it to new lots of nuts over and over again, it has been proved in commercial operations that *one part* will bleach perfectly over twenty times its weight of nuts.

6. The chemistry of the solution demonstrates that the process is absolutely harmless, and when operated according to recommendation upon perfect nuts there is no evidence left, other than that *desired*, that the nuts have been treated.

VITICULTURE AND OLIVE CULTURE.

PRESERVATION OF UNFERMENTED GRAPE-MUST.*

By Frederick T. Bioletti and A. M. dal Piaz.

The use of unfermented grape-juice or "must" as a beverage, both in health and in sickness, has been common in vine-growing countries from time immemorial. It has, however, until lately been restricted to the immediate vicinity of the vineyards and to the season of ripe grapes. This is owing to the great facility with which fruit juices of all kinds spoil within a few days after being expressed from the fruit, unless preserved artificially. The great progress made within the last few decades in methods, both legitimate and illegitimate, of food preservation, has made it possible to keep grape-juice for an indefinite period, and to make use of it as a beverage at all seasons and in all places. Accordingly the manufacture of grape-must has attained notable proportions in some European countries, and in some parts of the United States. Its use, however, has up to the present day been almost exclusively medicinal, although it is one of the most wholesome and agreeable beverages known, in health as well as in disease. The cause of this restricted use is twofold. In the first place, in order to simplify and cheapen the processes of manufacture, injurious preservative agents have been made use of by the ignorant or unscrupulous; and, in the second place, the lack of the necessary special knowledge and technical skill has resulted in many failures of attempts to preserve the must in a legitimate manner, so that the price has been necessarily too high for the regular consumer.

It is to remedy this lack of knowledge on the part of the manufacturer, to warn the consumer against the injurious effects of antiseptics, and to call attention to the merits of this delicious beverage, that this bulletin is written. More stress is laid on general principles than on actual methods, as the methods will vary considerably according to the scale on which the manufacture is conducted, and according to the facilities and appliances at the disposal of the individual manufacturer. The business can be conducted profitably with either small or large quantities, but must necessarily be commenced on a modest scale by the inexperienced. The directions given here should enable almost any grape-grower to commence operations, and gradually, as he acquires confidence and skill, to engage more largely in what should be an important industry in California.

Composition of Grape-Must.—A consideration of the following table, showing the constituents of the normal juice of ripe grapes, will make clear its value as a nourishing beverage in health, and also its therapeutic efficacy in certain cases of disease:

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*The edition of this Bulletin, No. 130, has been exhausted, and hence its republication here has been thought advisable.

	Parts in 1,000.
Grape sugar (dextrose and levulose)	180 to 280
Free organic acids (tartaric, malic, and tannic)	1 to 10
Salts of organic acids (cream of tartar, potassium malate, calcium tartrate, calcium malate)	4 to 8
Ash (containing potassium, sodium, calcium, magnesium, ferric oxid, phosphoric and sulfuric acids)	3 to 5
Nitrogenous matter (proteids, amido-compounds)	3 to 10

This table shows that some of the principal constituents of wine, such as alcohol, glycerine, etc., are totally lacking in pure grape-juice; and it is to be noted that it contains no unwholesome substance of whatever kind.

Grape-juice should and can be delivered to the consumer so as to contain no other substances than those shown above. If chemical analysis shows any other ingredients, a fraud has been practiced; and as all the additions usually made are in the nature of antiseptics or preservatives, they are all more or less injurious. All the antiseptics used are easily detected by more or less simple chemical tests, and if an effective pure-food law were in operation it would be easy for the consumer and the honest producer to protect themselves by occasional chemical analyses of the various brands of grape-must on the market. In the larger European countries, where such laws do exist, the use of injurious adulterants is rendered dangerous, if not impossible.

An analysis of a pure grape-must made by a government chemist in Austria, and one of must put up by Swett & Son, at Martinez, made by Mr. G. E. Colby at this Station, gave the following results:

ANALYSES OF GRAPE-MUST.

	Austria.	California.
Solid contents by spindle (Balling)	21.62%	20.60%
Alcohol	none.	none.
Total acid (as tartaric)	.78	.53
Volatile acid	.01	.03
Grape sugar	19.62	19.15
Cream of tartar	.61	.59
Free tartaric acid	.03	.07
Ash	.37	.19
Phosphoric acid	.02	.04

No cane sugar, starch sugar, or antiseptics were found in the California or the Austrian musts. Artificial (anilin) coloring matter, salicylic, benzoic, and boracic acids, formalin and fluorids were tested for in the California must, but none were present.

This is approximately what should be shown by any pure grape-juice. It is instructive to compare this with some partial analyses, made at this Station, of some of the beverages offered to the consumer in California under such titles as "Unfermented Wine," and "Pure Grape-Juice," recommended for invalids and for communion purposes:

SAMPLE 1—"UNFERMENTED WINE."

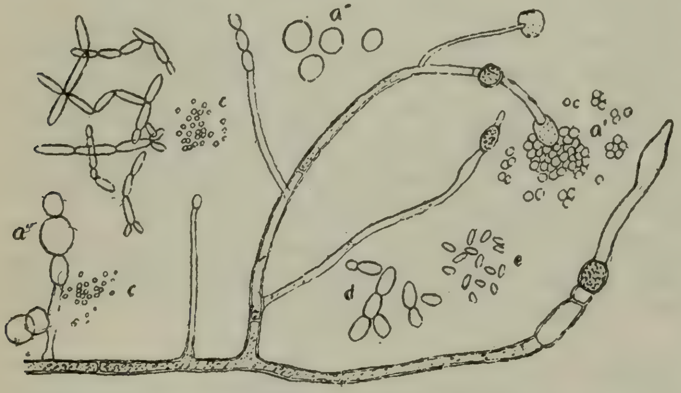
	Per Cent.
Solid contents by spindle	22.00
Total acids (as tartaric)	.59
Sulfurous acid (antiseptic)	.06

SAMPLE 2—"GRAPE-JUICE."

Solid contents by spindle	20.80
Alcohol, by volume	2.00
Salicylic acid (antiseptic)	3.90

The first sample was sold as a "curative for throat and lung troubles." The amount of sulfurous acid it contained was sufficient to *cause* throat and lung as well as digestive troubles in a healthy person. The second sample was sold as "pure unfermented grape-juice," but besides containing a large amount of the injurious antiseptic salicylic acid (more than twenty times as much as was necessary to preserve it), it contained two per cent of alcohol. Even healthy persons, much more invalids, would contract severe indigestion from the use of such a product, which is a fraud upon the public.

Causes of Spoiling.—In order to make clear the nature of the problem which must be solved in order to preserve grape-juice indefinitely, a short account of the causes of spoiling will be useful. When grapes, or any fruits, are gathered, the surfaces in contact with the air have the spores of various fungi, yeasts, and bacteria adhering to them. All these spores are microscopic, but an idea of their appearance, when sufficiently enlarged by the microscope to be visible, may be obtained by reference to Fig. 1, which shows various forms of these organisms developed on the skin of a Muscat grape.



a, a′, a″. Various forms of a mold (*Mucor*).
c, d, e. Various forms of yeasts, molds, and bacteria.

Fig. 1. MICRO-ORGANISMS ON GRAPES.

When the grapes are crushed and the juice expressed, the latter will be contaminated by these spores, washed off the skin. In the air they are dry, and therefore inert; but very soon after they are surrounded by the must, which is a very favorable medium for their growth, they assume an active form and commence to multiply. If the must is warm, this change to an active state occurs very soon and the consequent increase in numbers is proportionately rapid. If, on the contrary, the grapes and therefore the must be cool, the increase is much slower; but, eventually, if left alone the organisms increase until the must ferments. This fermentation consists principally in the changing of the grape sugar into alcohol and carbonic acid, and is the essential part of the process which changes grape-juice into wine.

The main object, then, of the producer who wishes to place "pure unfermented grape-juice" upon the market, is to permanently prevent this fermentation. Besides this, the grape-juice must be quite clear, in order to present an attractive appearance to the consumer.

To attain the first object there are two general groups of methods, which may be called respectively *chemical* and *physical*. All the chemical methods consist in the addition of germ poisons or antiseptics, which either kill the microscopic organisms of fermentation or permanently prevent their growth and increase. Of these substances the principal used are, besides salicylic and sulfurous acid already mentioned, boracic acid, ammonium fluorid, saccharin, and, of late, formalin. Many patent preservatives are found on the market, but they nearly all contain one or more of these substances as their active principle. They are all injurious to digestion and in other ways; and it may be said in general that *any substance which prevents fermentation will also interfere with digestion*, and is therefore to be avoided.

The *Physical* methods work in one of two ways: they remove the germs by some mechanical means, such as a filter, or a centrifugal apparatus; or they destroy them by heat, cold, electricity, etc. The methods which depend upon the removal of the germs are inapplicable, as this can not be done thoroughly except with very small quantities of liquid, and the minute organisms with which we have to deal will soon increase sufficiently to spoil the liquid, if a single one escapes the filter. One yeast-cell, for instance, at ordinary temperatures will increase to tens of millions in three or four days; and if the temperature is warm the increase will be still more rapid. We are, then, reduced to those physical methods which destroy the germs; and of these the only one which has been found useful in this connection is the use of high temperatures. This method depends on the fact that when a liquid is heated to a sufficiently high temperature all organisms present are killed. This temperature is called the "death point," and differs for each particular variety of organisms. The death point will also differ according to the composition of the liquid in which the organism is immersed. Yeast, for instance, is killed at a lower temperature in must than in water, on account of the acidity of the former. Time, also, is a factor in determining the death point. An organism may not be killed if heated to a certain degree quickly and as quickly cooled; while if it is kept at that same degree for some time it will be killed. Some tests made at this Station with a pure* yeast isolated from a California wine illustrate these facts. The yeast was placed in must which had previously been completely freed from all germs, and was heated to various temperatures for various lengths of time, with results as follows: The initial temperature of the must was 20° C. (68° F.) and the yeast was killed by heating it gradually up to 60° C. (140° F.) in fifteen minutes; that is to say, the time taken to bring the temperature from 20° C. (68° F.) to 60° C. (140° F.) was fifteen minutes, and at the end of this time the must containing the yeast was allowed to cool in a room at 20° C. (68° F.). This same yeast was not killed when heated in twenty-five minutes from 20° C. (68° F.) to 50° C. (122° F.), nor even when kept at the latter temperature for five minutes longer. But when kept at this temperature for ten minutes longer, all the yeast cells were killed. Another test with the same yeast showed that if heated from 20° C. (68° F.) to 45° C. (113° F.) in twenty minutes, and then kept at the latter temperature for twenty minutes, few or none of the yeast-cells were killed, though in thirty minutes most of them were rendered incapable of growth. However, even in the last case some were left alive and ultimately spoiled the must. We learn from these tests that heating to 45° C. (113° F.), even for a somewhat prolonged time, can not be depended upon to sterilize grape-must, and that even 50° C. (122° F.) requires too much time to be practical. A heating to 60° C. (140° F.), however, would probably be quite safe, provided that only this particular variety of yeast were present in the must. In practice, however, we have an unknown number of kinds of micro-organisms present, and some of them may be able to withstand a somewhat higher temperature than this.

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*Pure in this case means a yeast consisting of only one variety of micro-organism.

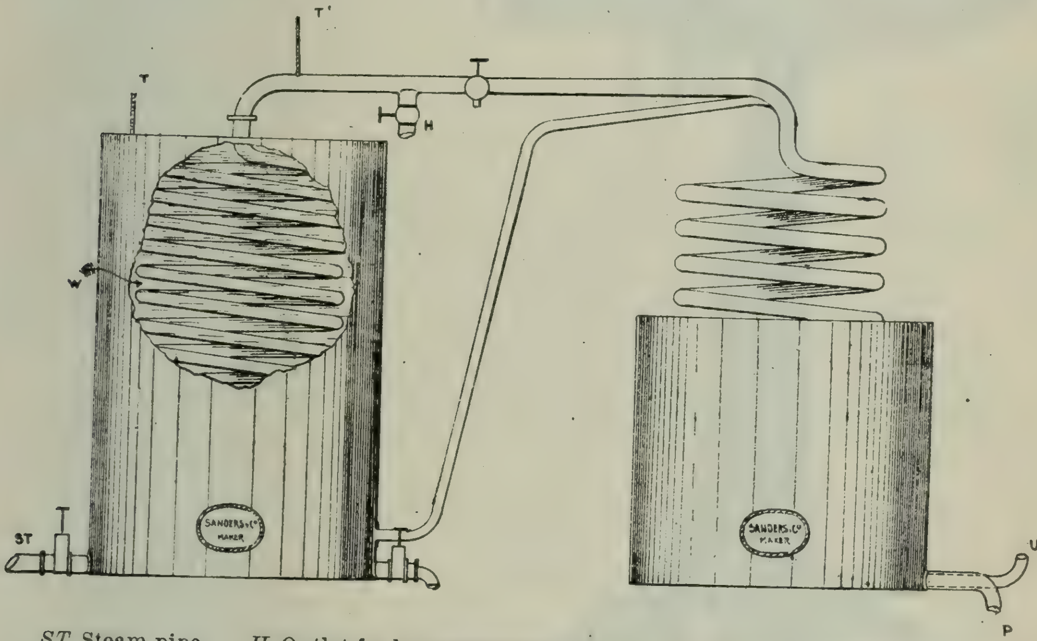
It must be kept in mind also that fungi, including yeasts, exist in two states: the vegetative or growing state, and the spore or resting state. The latter is more resistant than the former; and it has been found that yeast spores, for instance, to be killed must be heated about 5° C. (9° F.) higher than the same yeast in the growing state. The above tests were made with yeast containing no spores; but, as in practice, spores may be and undoubtedly usually are present, a temperature 5° C. (9° F.) higher than indicated would be necessary. Practical experiments made at this Station indicate that must can be safely sterilized at a temperature of 75° C. (167° F.) or 80° C. (176° F.) if all the precautions indicated below are observed. At this temperature the flavor of the grape-juice is hardly changed, though between 90° C. (194° F.) and 100° C. (212° F.) it is slightly affected.

Another property of fungi and their spores, which is of importance in this connection, is their great resistance to heat when dry. Yeast can be heated in a dry state to a temperature above that of boiling water without being killed; the spores of some fungi (*e. g.*, common mold) are even more resistant. The bearing of this upon the preservation of must is that, during the final sterilization which takes place in glass bottles or similar vessels, portions of the inner surface of the cork and of the bottle above the liquid are comparatively dry; and if any spores should be adhering to these parts there is danger that they will not be killed, and that afterward, when they come in contact with the must, they will grow and cause fermentation or mold. For this reason both the bottles and the cork must be thoroughly sterilized *before* being used. This can be accomplished for the bottles by boiling them for at least half an hour after thorough washing, and then allowing them to drain in a place where they are exposed to no draughts or dust. This boiling should be done as short a time as possible before filling the bottles, and they should be handled carefully, taking care not to touch their mouths, for with the greatest care the hands can not be kept free from mold spores. To sterilize the corks this method is not always sufficient, as spores that may be in cracks are liable to escape. For sterilizing the corks, some closed receptacle should be used which will safely withstand considerable pressure. The corks when placed in this receptacle can best be sterilized by steam under pressure, which is allowed to flow in until the pressure, as shown by a gauge, is at least ten pounds. This pressure indicates a temperature of about 115° C. (239° F.), and should continue for at least twenty minutes.

Apparatus Required.—The apparatus necessary for preserving grape-must on any but the very smallest scale consists of: (1) a continuous pasteurizer; (2) a pressure filter; (3) a pressure sterilizer for corks (this may be dispensed with); (4) a bottle pasteurizer; (5) a boiler for pressure steam. Certain other utensils are, of course, necessary, but they are such as are found in almost every wine-cellar.

The Manner of Operating.—The method of proceeding is as follows: Sound, clean grapes, preferably those having high natural acidity, are picked carefully, while cool, into clean boxes. They should not be too ripe, or the must will be too sweet and difficult to clear. They should be crushed as soon as possible after picking, and the juice run into perfectly clean puncheons or other receptacles which have been previously steamed. If the must is cold—15° C. (59° F.) or under—it may be safely left to settle for twenty-four hours or more. This settling is an advantage, as it rids the juice of most of the floating solid matter, and facilitates the subsequent filtering. During this settling the must should be closely watched, in order to anticipate even a commencement of fermentation. After this settling, when the must has become almost clear, it is run through a continuous pasteurizer, one form of which is shown in Fig. 2.

It is heated in this to 80° C. (175° F.) and should come out cool, not warmer than 25° C. (77° F.) and should pass into fresh settling receptacles. For this purpose puncheons or other casks may be used, if they have been thoroughly sterilized by steam, though the best receptacles would doubtless be casks or vats of metal lined with enamel, such as are now made. The greatest care must be taken to avoid contamination of the must as it flows from the pasteurizer. It should pass directly, by means of a block-tin pipe, from the pasteurizer into the receiving casks. The end of this pipe should be thoroughly sterilized by plunging into boiling water, and should never be allowed to touch the hands or any exposed surface. When a receiving cask is full it should be closed immediately with a wooden bung, sterilized previously in the way already described for corks. If all these operations have been conducted with the requisite care, and the casks kept in a cool cellar, the must will remain without fermenting for many days or even weeks. During this time it deposits more or less sediment which has been formed in heating. It is then ready for filtering.



ST. Steam pipe.
W. Water bath.
H. Outlet for hot pasteurized must.
P. Outlet for cooled pasteurized must.
U. Inlet for unpasteurized must.
T, T'. Thermometers.

FIG. 2. CONTINUOUS PASTEURIZER.

Filtration.—This filtration is best accomplished by means of a filter so constructed that the must passes upward through the filtering medium, under pressure. Such a filter, made by the International Filter Company of Chicago, is shown in Fig. 3.

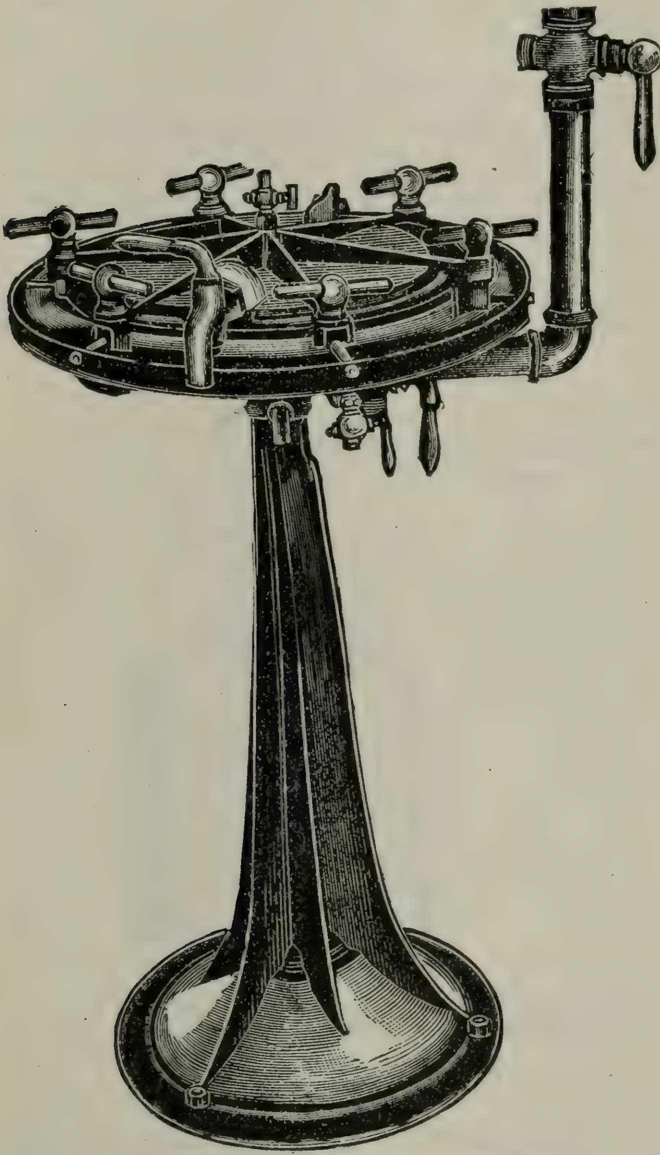


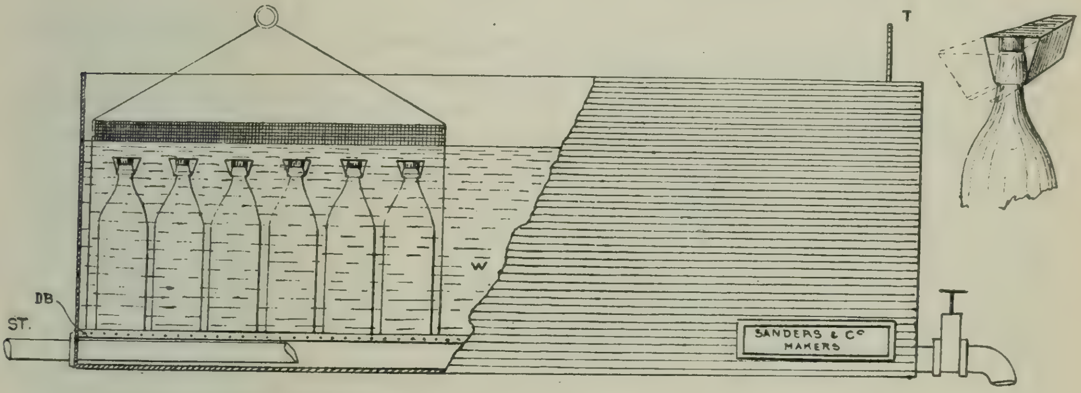
FIG. 3. FILTER FOR CLARIFYING MUST.

This filter consists essentially of two shallow bowls clamped together mouth to mouth, with the filtering medium between them. The unfiltered must enters the lower bowl through the pipe on the right of the figure, passes through the filtering medium into the upper bowl, and makes its exit when clear through the faucet a little to the left of the middle of the figure. The small faucet at the bottom of the lower bowl is for the purpose of cleaning the filter. Occasionally, when filtration becomes slow, this faucet is opened for a few moments. This allows the sediment accumulated at the bottom to escape and at the same time the entering must takes a rotary course in the lower bowl, thus cleaning off the surface of the filtering medium; so that when the cleaning faucet is closed filtration proceeds as before. On a large scale, a filter press, such as is used in large wineries and in beet-sugar factories, might conveniently be used.

It is impossible to prevent a certain amount of contamination by fungous spores during filtration; but it should be minimized as much as possible by the greatest cleanliness, and attention to sterilizing everything with which the must comes in contact. In this regard it should be kept constantly in mind that in an ordinary room or cellar, where there is little dust, there is comparatively little danger of contamination from the air, the main danger being from the solid surfaces with which the must comes in contact. The must may be bottled directly as it flows from the filter, or it may pass into a sterilized temporary receptacle, from which it is bottled. It should, however, be placed in its final receptacles (bottles, etc.) the same day on which it is filtered, corked immediately, and sterilized finally as soon as possible, preferably within twenty-four hours.

Final Sterilization.—On account of the re-contamination during filtration, a final sterilization must be made after the bottles are corked. This is accomplished by means of a bottle-sterilizer, which the producer himself can construct. A simple and efficient form is shown in Fig. 4.

It consists of a wooden box or trough provided with a wooden grating placed about two inches from the bottom. The bottles, after being filled with the filtered must and corked, are placed in perforated or wire baskets, which rest upon the grating. The trough should contain enough water to completely submerge the bottles. The water should be kept at a constant temperature of about 85° C. (185° F.) by means of a steam coil placed beneath the grating. The bottles should be left in this pasteurizer for exactly fifteen minutes if they are one-quart champagne bottles. For other sizes it is necessary to make a test with a bottle of must in which a thermometer has been placed, in order to determine how long it takes for the entire contents of the bottle to reach the required temperature. It has been found at this Station, that although the must in the upper part of a quart champagne bottle reaches 75° C. (167° F.) in eight minutes, when surrounded by water at 85° C. (185° F.) it requires fifteen minutes before the must at the bottom of the bottle acquires that temperature. The sterilization in bottle should be conducted at a temperature at least 5° C. (9° F.) lower than that reached in the continuous pasteurizer. Thus, if the water in the first case was kept at 90° C. (194° F.) or 95° C. (203° F.) and the must attained a temperature of 80° C., the water in the bottle pasteurizer should be kept constantly at 85° C. and the time of pasteurizing so chosen that the must in the bottles will attain a maximum temperature of 75° C. (167° F.). *If the final heating is higher than the first, it may cause a precipitation of solid matters, which will make the must cloudy in the bottles.*



DB. Double bottom. *ST.* Steam pipe. *W.* Water bath. *T.* Thermometer.
(Bottle shows method of adjusting a cork-holder of sheet metal.)

FIG. 4. CORK CLAMP AND PASTEURIZER FOR MUST IN BOTTLES.

During this sterilization in bottles the corks are liable to be expelled by the pressure developed. To prevent this they may be tied down with strong twine; but it is a great saving of time and labor to use some such contrivance as that illustrated in Fig. 4.

By this operation the must is thoroughly sterilized and will then keep unchanged for years, or until the bottles are opened. If, however, the bottles are to be capsuled, or kept in a very damp place, there is one other cause of spoiling that must be guarded against. However carefully all the various operations are conducted, there are sure to be mold spores on the upper surface of the cork. If this surface remains dry these spores will not grow, and are harmless. But when the cork is covered with a capsule the space between the capsule and the surface of the cork finally becomes moist, and any spores there will develop. Some molds have great penetrating power and may force their way either through the cork, or between the cork and the neck of the bottle (especially if the very best quality of corks has not been used) and finally reach the must. The molds which enter in this way do not, as a rule, grow into the liquid, on account of the small amount of air present; but they make a moldy layer on top, which lessens the selling value of the must, if it does not actually spoil it. This danger can be avoided by dipping the top of the neck of the bottle into a two per cent solution of bluestone and water, in such a way as to wet the upper surface of the cork, before putting on the capsule. The same object may be attained by dipping the neck, in the same way, into very hot, melted paraffine. The bluestone acts by killing any spores that may be on the cork or which may find their way there later. The heated paraffine kills the spores present, and prevents later infection by completely covering the cork and keeping it dry.

The quality and character of the grape-juice prepared in this way will vary greatly according to the variety of grape used; and a pleasing variety may be obtained by using, partially or wholly, grapes of high aroma, such as Muscat, Isabella, etc. The color will, however, always be white or yellowish except with a few grapes, such as the Bouschets, which have pink or red juice. Red must, however, can be obtained by a modification of the process described. If the must, after it passes through the continuous pasteurizer, is allowed to come out hot and flow into a vat containing the skins of red grapes, almost any desired depth of color may be obtained, depending on the variety of grape used and the time during which the hot must is left in contact with the skins. Must prepared in this way, however, differs in other respects than in color from the white must. Besides coloring matter various substances are extracted from the skins, the principal being tannin. This makes the composition of the red must more like that of red wine, though of course it still contains no alcohol. A grape-juice of this character might appropriately be called "Unfermented Wine," and would doubtless be useful in medicine, as it would possess certain tonic properties not found in the white must. The regular consumer, however, would in all probability generally prefer the white must.

Grape-must, containing as it does generally from twenty to twenty-four per cent of sugar, is too sweet for many palates and constitutions, but it may be diluted with water by the consumer to any desired extent; and a mixture of equal parts of grape-must and carbonated or mineral water makes a beverage much appreciated by many people. In Europe a certain amount of sparkling grape-juice is put up, *i. e.* grape-juice which has been carbonated, or charged with carbonic acid gas. This, though an addition to the natural juice of the grape, can not be looked upon in any sense as a fraud or adulteration, and makes the beverage more palatable to many; besides if properly done it has no injurious effects on the health of the consumer.

In conclusion, the following brief summary of the main precautions to be observed in the manufacture of unfermented grape-must may be useful:

1. Only clean and perfectly sound grapes should be used.
2. The grapes should be picked and handled when cool.
3. The greatest cleanliness is necessary in every stage of the process.
4. All utensils and apparatus used should be cleaned and sterilized immediately before using, and as short a time as possible after using.
5. The last sterilization should be at a temperature at least 5° C. (9° F.) lower than the temperature used in the first sterilization.
6. Reliable thermometers should be used, and the temperature watched very carefully.

BENCH-GRAFTING RESISTANT VINES.

(Bulletin No. 127.)

This bulletin, issued in 1900 by Messrs. F. T. Bioletti and A. M. dal Piaz, and not reprinted because still available for distribution, reviews the history of the introduction of the resistants into California and the lack of success. The work of the Experiment Station with these vines is then taken up and the results of the culture tests are given, together with the various methods of grafting and callusing, planting grafts in the nursery, and comparative experiments in rooting cuttings of resistant stocks. The following is the summary of results and conclusions:

1. Every grape-grower should insure against phylloxera by testing the most promising resistant vines on his own place, and by learning the methods of bench-grafting.
2. It is unsafe to attempt operations on a large scale with cuttings imported from abroad, on account of the danger of injury to such cuttings on the journey.
3. A cutting-graft of suitable varieties makes as large and vigorous growth as a simple cutting, so that by the method of bench-grafting no time is lost in establishing a resistant vineyard.
4. Resistant varieties which are difficult to root but easy to graft when old, such as Lenoir, should not be bench-grafted.
5. Care in callusing, planting, and treatment in nursery, and especially in keeping the grafts moist from the time they are made until they are in the callusing bed, will enable even an inexperienced grafter to obtain at least 60 per cent of good, grafted plants in suitable locations.
6. The bluestone should be washed off the outside of the raffia before tying, or it will injure the bark of the graft.
7. Callusing in sand insures more perfect unions and a larger per cent of successful grafts than planting directly in the nursery.
8. The moisture in the callusing bed should not be excessive, and the temperature should be relatively warm.
9. The growing grafts should be watched closely, in order to see that the roots of the scions are removed before they become large, and that the raffia is cut before it strangles the graft.
10. The English cleft graft is preferable to the Champin graft, because it gives more perfect unions and can be made with more accuracy and rapidity.

11. Scions of two eyes are preferable to those of one eye, as they give more chances of success.

12. Rupestris St. George seems to be remarkably adapted to California soils (except the heaviest clays) and conditions, and is to be preferred to any variety yet tested here wherever deep penetration of roots is possible and desirable.

13. All the eyes of the Rupestris stock should be cut out deeply and carefully.

14. A vigorous and large-growing Vinifera scion promotes an equally vigorous and large growth of Rupestris St. George used as stock.

REPORT ON THE CONDITION OF OLIVE CULTURE IN CALIFORNIA.

(Bulletin No. 129.)

This bulletin, by A. P. Hayne, was issued in May, 1900, in response to a demand for information on the cause of olive-culture failures in the State. After investigations conducted in various parts of the State, the following conclusions were reached: The causes of failure were found to be among the following:

Cultural Conditions: Improper selection of soils; neglect of tillage and irrigation; neglect of proper pruning; and neglect in fighting insect pests.

Commercial Conditions: Competition with cottonseed oil and others sold as olive oil; poor harvesting and manufacturing methods; and selection of unsuitable varieties.

These several conditions are separately discussed in the bulletin. A chapter on methods of pickling olives is also given. This bulletin is also available for distribution.

ENTOMOLOGY.

SOME INSECTS OF THE YEAR 1899-1900.

By Carrol Fowler.

The San José Scale (*Aspidiotus perniciosus*), Plate 1, although kept pretty well under control generally throughout the State, is by no means, and probably never will be, exterminated. In many localities there have been serious outcroppings. Some specimens sent in for identification show it in its worst form. We have located it in many places along the coast from Humboldt to San Diego and in the San Joaquin Valley. It is also reported as occurring in Placer and El Dorado counties. Parasites are undoubtedly doing much toward keeping this pest in subjection, but they can not be relied upon entirely. No place can be considered safe from its attack, and wherever it appears upon deciduous fruit trees winter spraying with lime, salt, and sulfur should be resorted to. In some places trees are now dying on account of failure to do this during the past winter.

The Black Scale (*Lecanium oleæ*), Plate 2, is found all over the coast regions of the State, particularly on citrus fruits and olives. It is also reported from Sacramento and Stanislaus counties. On the orange and lemon, fumigation with hydrocyanic acid gas is being generally practiced. On the olive, kerosene emulsion and rosin soap prove very effectual; and at Santa Barbara, Kale's distillate wash has been reported as satisfactory and economical.

The Red Scale (*Aspidiotus aurantii*), Plate 3, appears generally distributed over the southern part of the State, and the yellow variety, called the yellow scale, occurs sparingly in the north. Some leaves badly affected with the latter have been received from Sacramento County, where this insect has been known for many years. Fumigation is the remedy.

The Purple Scale (*Mytilaspis citricola*), which was imported from Florida some years ago on nursery stock, has become established in several of the counties south of Ventura, and has made an appearance in one or two orchards of that county, but the Horticultural Commissioners are making a decided effort to stamp it out. I have seen oranges from fruit-stands here at Berkeley almost covered with these scales. Although these insects are more generally distributed on nursery stock, yet the shipping of such fruit will aid in spreading the pest to other localities. Like the red scale, this insect readily succumbs to hydrocyanic acid gas.

The Soft Orange Scale (*Lecanium hesperidum*), although pretty generally distributed, is highly parasitized and becomes destructive only occasionally in limited sections. A thorough spraying with kerosene emulsion will usually clean the trees.

The Greedy Scale (*Aspidiotus camelliæ*), occurring on a great variety of plants, is frequently bad, especially on pear trees. This also has its

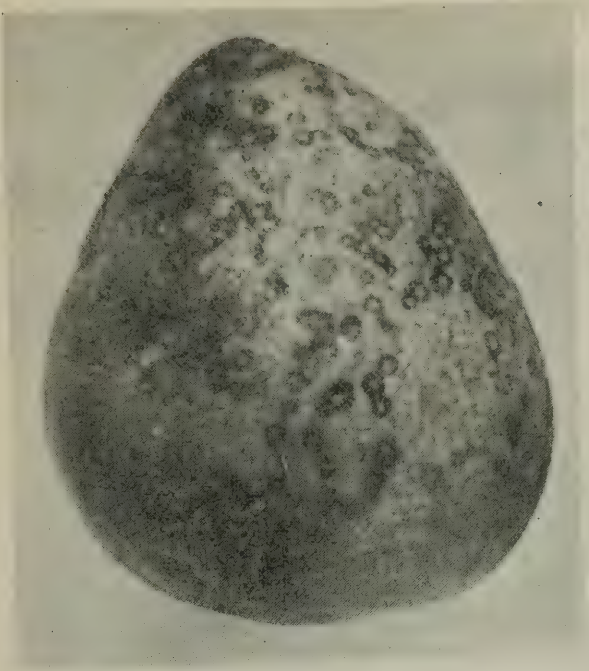


Plate 1. San José Scale (*Aspidiotus perniciosus*).

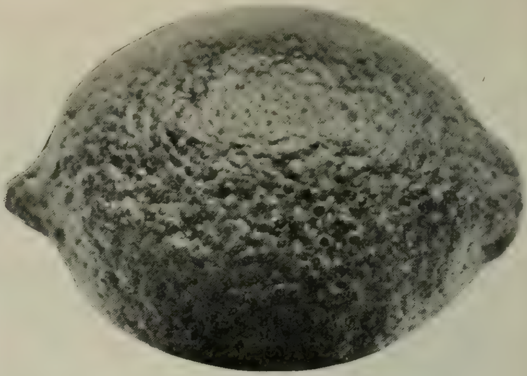


Plate 3. Red Scale on Lemon.

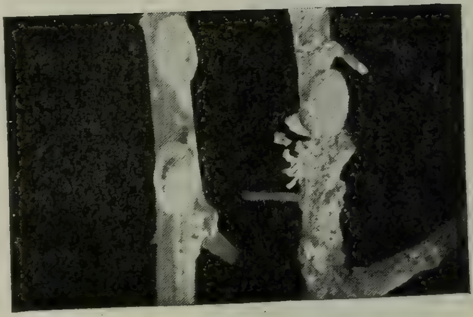


Plate 4. Pruinose Scale on Walnut.

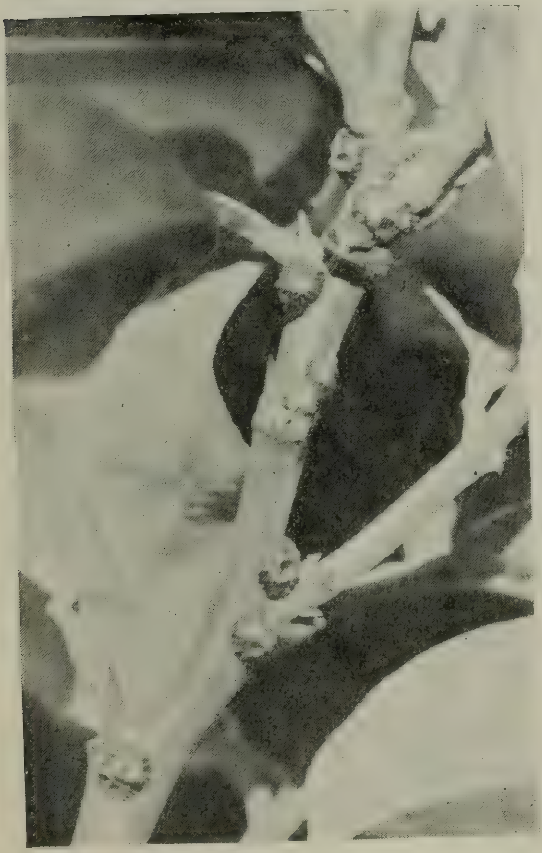


Plate 2. Black Scale on Orange.

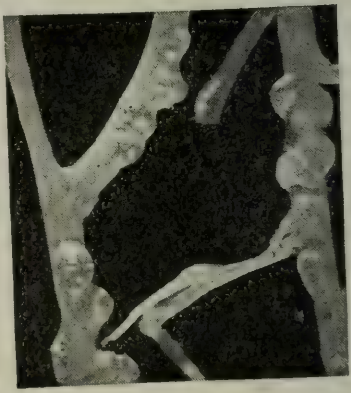


Plate 5. Brown Apricot Scale on Oak.

parasites, but they do not keep it in subjection. Winter spraying with lime, salt, and sulfur is most effective. Summer spraying with kerosene emulsion or rosin soap will do much to rid the trees of the pest.

The Pruinose Scale (*Lecanium pruinosum*), Plate 4, which attacks many deciduous trees, as prune, plum, cherry, apricot, pear, apple, walnut, grape, and some others, and the Brown Apricot Scale (*Lecanium pruinosum*, var. *armeniacum*), Plate 5, occurring most commonly on the peach and closely allied to the above, are serious pests. Specimens of the former on prune are most commonly sent in for identification. Both of these occur quite generally throughout the State and are especially destructive in the San Francisco Bay region. A small hymenopterous parasite, *Comys fusca*, is proving efficient in reducing the numbers of the former in some localities. Winter spraying with strong kerosene emulsion is the most effective remedy. Lime, salt, and sulfur will destroy the *Lecanium pruinosum*, which passes the winter in an immature stage.

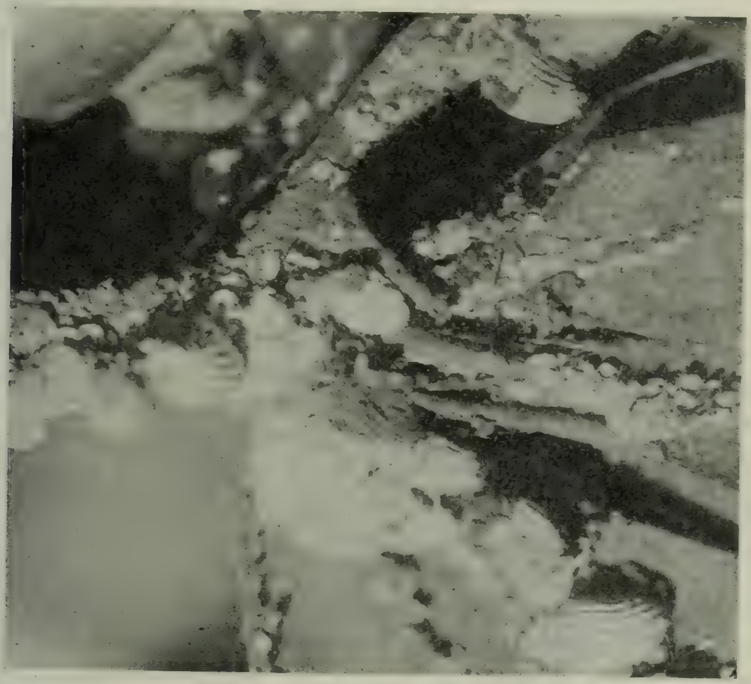


PLATE 6. The Cottony Cushion Scale.

The Cottony Cushion Scale (*Icerya purchasii*), Plate 6, is the one which a few years ago was so very destructive to citrus trees in Southern California, and which was almost stamped out by the ladybird, *Vedalia cardinalis*. There are frequent outcroppings of this scale in different parts of this State, and we have many inquiries concerning it. Since the parasites are kept for distribution by the State Quarantine Officer there is no reason why trees should be allowed to suffer.

Cutworms appear everywhere and are a serious menace to a great variety of crops, especially garden truck. Orange seed-beds and grapevines have suffered considerably. By cleaning up all rubbish and burning it during the winter the number of these pests will be very materially reduced. The most successful treatment is by means of a bait prepared by mixing twenty pounds of bran, ten pounds of middlings, and ten pounds of arsenic, and adding to this one gallon of cheap molasses and just enough water to moisten. A tablespoonful of this should be placed near the base of each plant. By spraying clover or some other green vegetation with Paris green at the rate of one pound to fifty gallons of water, and then scattering over the ground before the plants come up in the spring, a field may frequently be entirely freed from the pests. One species, however, the Variegated Cutworm (*Peridroma saucia*), occurs occasionally in great numbers. Last year we had reports of it from Mendocino and Humboldt counties, where much damage was done to garden crops. Mr. J. W. Hall, writing from Miller, California, under date of July 31st, says: "It is the first experience we have had with the pests, and it looks as if they might take about all of my late garden peas, of which I have about sixty acres. I first noticed them about two weeks ago, when they cleaned up an onion patch, and during the last week they have spread very rapidly." Mr. David Hill, writing from Arcata at the same time, says that it is the first time he has been troubled with them and that "they have entirely destroyed the crops which they are working upon. One neighbor, paying $10 an acre rent, has thirty acres of peas that a week ago promised sixty bushels per acre, which would have been worth from $1,500 to $1,600; now it will probably not be worth cutting. * * They are not confining themselves to peas alone, but are destroying clover, potatoes, corn, and beets, and damaging all other vegetation."

When the cutworms appear in such large numbers the only thing that can be done is to prevent as far as possible their spread to adjacent fields. This is most easily accomplished by plowing a deep furrow around and throwing the earth toward the infested plot. All clods should be removed, so that when the worms crawl down into the furrows they will be unable to get out. Post holes should be dug at frequent intervals in the ditch, so that the worms crawling along the furrow will fall into them, where they may subsequently be destroyed with kerosene or water, or by burying. There is some objection to the idea that this species migrate, but when they occur in such large numbers it is quite certain that they do go from one field to another, but, as Mr. Marlatt suggests, most probably at night.

The Canker or Measuring Worms (*Anisopteryx autumnata*), so far as we have been able to determine, have been injurious only in the Sacramento Valley and San Francisco Bay counties. In Solano County they have this year been especially destructive. Paris green has been applied with varying results, which generally have proved unsatisfactory. Kerosene emulsion has been recommended, and would no doubt kill all with which it should come in contact. The hatching period is so long, however, that it would necessitate more than one application. The dissolving of Paris green in ammonia should not be practiced, as the effectiveness of the spray is not increased and serious injury is apt to result to the tree. A simple and effective preventive is the banding of the trees in the fall earlier than November, to prevent the wingless females from climbing the trunk to lay their eggs. These bands may consist of a piece of paper fastened around the tree, over which some sticky substance, as tar, printer's ink, etc., is smeared, or better of wire netting of about No. 16 mesh. To prepare the latter, cut the wire into strips about six inches wide and wrap bands around the trunk of the tree, fastening in place by means of a cord or wire bound tightly around the upper edge.

The lower edge of the wire must not touch the tree. The moths will collect under this and perish. If a narrow piece of cotton batting is placed between the upper edge of the wire and the tree, the trap will be more secure.

The Peach Tree Borer (*Sannina pacifica*), which attacks peach trees and such others as are grafted upon peach stocks, has proven most serious in Santa Clara, Santa Cruz, and San Mateo counties. It enters the tree just below the surface of the ground. A large percentage of the borers can be kept out of the trees, either by hilling-up the earth around the crown, wrapping with tarred paper, or, as recommended by Professor E. J. Wickson in his book on California fruits, "by coating the base of the tree a few inches below the surface and a foot above with a whitewash, made with a pint of coal tar to each five pounds of quicklime, put in while the lime is slaking. This should be done in April." It is well to examine the trees in the fall and with a knife to remove any borers present.

The Peach Twig Borer (*Anarsia lineatella*) has proven quite a serious pest in the Sacramento and San Joaquin valleys and in the San Francisco Bay region. These insects pass the winter as larvæ in shallow burrows in the trunks and branches of the trees, and may be easily killed by spraying with kerosene emulsion before the buds open in the spring. Later spring treatment with Paris green is generally unsatisfactory, owing to the difficulty of reaching the insect on account of its boring habit.

Diabroticas, or Cucumber Beetles, are represented generally throughout the State by the Striped Diabrotica (*D. trivittata*) and the Twelve-spotted Diabrotica (*D. soror*). These differ specifically from the common Eastern forms (*D. vittata* and *D. 12-punctata*), which they closely resemble, and they have different habits. Both species are generally distributed throughout the State. The Striped Diabrotica is especially injurious to cucumber and melon vines, while the Twelve-spotted Diabrotica is not infrequently destructive to fruit trees as well as flowers and vegetables. On trees little can be done to kill the beetles. Arsenicals are generally ineffective. By frequent cultivation and fertilization the trees will be kept in the best condition to withstand the attack. On cucurbits the dusting of the plants with pyretheum powder, or buhach, in the early morning while the dew is still on them, has produced very good results. A repellent made by thoroughly mixing a tablespoonful of coal oil or turpentine with a quart of air-slaked lime and scattered on and around the plants is recommended for the Eastern form, and will probably prove effective with our species.

The Squash Bug (*Anasa tristis*), found almost in every section where squashes and pumpkins are grown, is always more or less destructive. An application of the repellent recommended for Diabroticas is usually attended with fair results.

The Harlequin Cabbage Bug (*Murgantia histrionica*) has been reported as injurious in three counties, namely, Colusa, Tuolumne, and Monterey. A trap crop of mustard or radishes will attract a large number of the pests, where they may be killed by spraying with pure kerosene.

Pears and cherries suffer considerably almost every year from the attack of the Pear Slug (*Eriocampoides limacina*), a small slug-like larva. The slug fly deposits its eggs in the leaves, and the slugs upon hatching cut their way to the upper surface, where they feed. Closely allied to this is the Pear Saw Fly (*Gymnonychus californicus*), the larva of which, however, is not slimy, and the injury seems confined to pear trees. We have been unable to determine exactly the distribution of each species, but the latter seems to be the most serious in the Sacramento Valley, while the former has during the past year been quite destructive in the San Francisco Bay region. "Pear Slugs" are also reported from Humboldt, Madera, and Santa Barbara counties. Spraying with arsenicals is the best remedy. By applying fine road-dust many of the slimy kind may be killed, apparently smothered, although part of them when thus treated will simply cast their skins and consequently not be materially affected.

A serious pest to the plum and prune trees is the Plum-tree Aphis (*Aphis pruni*), which frequently occurs in large numbers on the leaves, especially the under side. Not only do these plant-lice injure the trees by sucking the sap, but in the honey dew which they excrete grows a black fungus or smut, which in some cases almost covers the leaves and fruit. Thorough spraying with kerosene emulsion as soon as noticed is the proper remedy. These insects proved most numerous in the counties bordering on San Francisco Bay, although we have reports of their appearance as far north as Lassen County, as far south as Kings County in the interior, and in Santa Clara County on the coast.

Quite similar to the Plum-tree Aphis is the Apple Aphis (*Aphis mali*), which is occasionally injurious to apples in the northern and central parts of the State. The injury is confined to the leaves and young shoots. Kerosene emulsion is the remedy.

THE LUPIN FLY (*Phorbia lupini*).

Among the lupins which have been introduced for the purpose of green-manuring is the Large White Lupin (*Lupinus albus*). It appears well adapted to our climatic and soil conditions and will, we believe, soon be largely planted as a winter green-manuring crop. But this plant, like so many others, has its enemies. The most formidable of these is a small white maggot which bores into the stem, either killing the plant or so weakening it that it makes but slight growth. Thus far, however, the attack has not been so great as to discourage future planting. Mr. L C. Gage, of Lincoln, Placer County, says that fully nine tenths of his lupins were infested. Here, at Berkeley, a very few plants were attacked. At the Paso Robles substation, J. H. Barber states that not over two per cent showed signs of attack. J. W. Mills, of the Southern California substation, says that the first planting last fall was practically killed outright, and that in the later plantings occasional plants were infected. At San Diego, according to Mr. August Storme, lupins suffered to some extent.

This maggot finally develops into a fly not unlike the house fly in general appearance, although somewhat smaller. The eggs are usually laid in the bud end of the young plant, rarely in the axil of the leaf. The larva then eats into the pith for a distance of two or three inches (Plate 7) until ready to pupate, when it may be found again in the bud end. When full grown its length is about one fourth of an inch. Here it changes to a brown pupa. In the breeding-cages the duration of the pupa stage ranged from five to six weeks. We have been unable to determine accurately the length of the larval period, but the larval and egg stages together occupy probably from five to six weeks; making, then, in all ten to twelve weeks for complete development. Plants that are attacked usually wither, sometimes die; at other times they remain green, but cease to grow. The stalk often becomes decayed. A young plant rarely contains more than one maggot, but those which have branched may contain a borer in each branch.

The fly does not confine itself entirely to *Lupinus albus*, although it is not generally found upon other species. Mr. Mills says that three years ago it killed all the European varieties except the blue variety of *angustifolius*. I have found it upon *Lupinus pilosus*, but to a very slight extent. Mr. Gage says: "We recognize the fly to be the same as the one that infested a Sweet William pink last year."

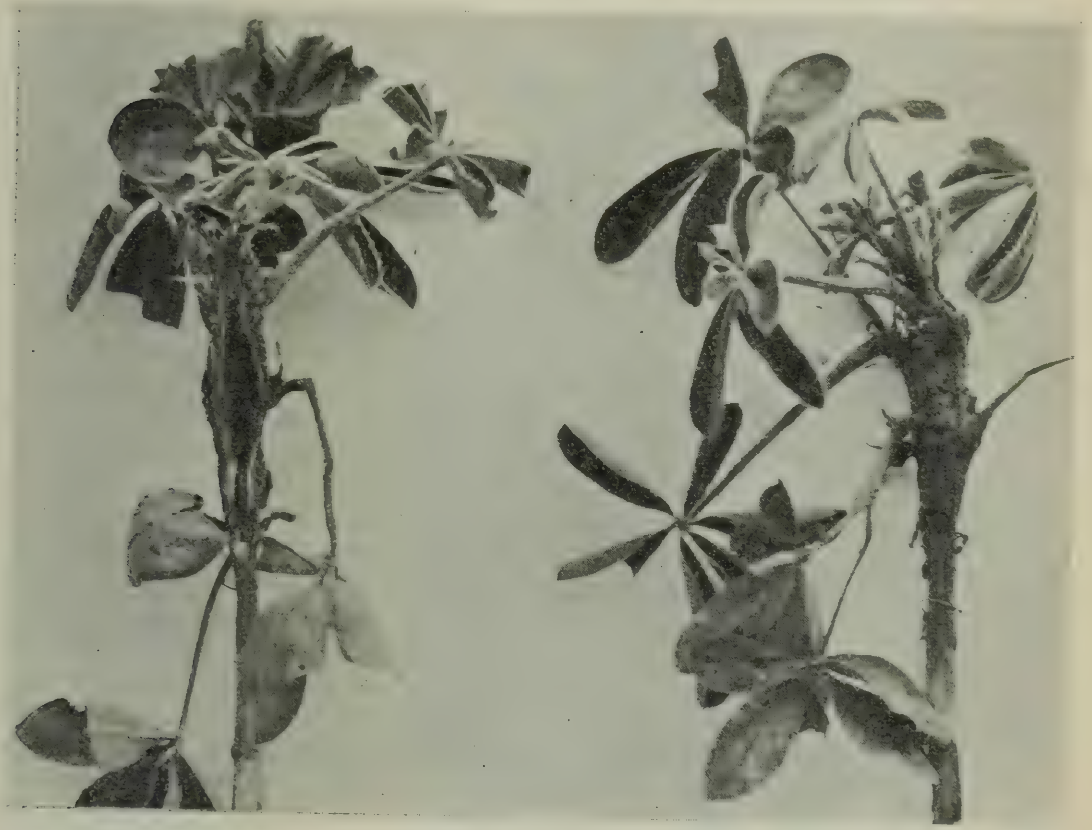


PLATE 7. LUPINS INJURED BY BORERS.

The fly is undoubtedly a native with us. Specimens sent to the United States Department of Agriculture for identification were found by Mr. D. W. Coquillett to be a new species, and he has drawn up a description of it under the name *Phorbia lupini*. There is a related species (*Anthomia funesta*) in Europe which attacks the lupins in a similar manner.

In Europe the lupins are grown during the summer, and the pests are kept in subjection by means of a trap crop planted early in the spring, this being destroyed as soon as it becomes infested. A similar plan might be followed here, since it is the early-planted lupins that suffer most. In the case of Mr. Gage's lupins, which were so badly damaged, the seeds were sown the first of October and were soon up. Mr. Mills states that his first planting of *Lupinus albus* was practically killed outright that season, while in the later plantings there were only occasional plants infected. Mr. Barber notes that in the case of those plants which came up about November 30th the injury was conspicuously less than in those which germinated uniformly in October. At Berkeley the injury was only slight. Some of these lupins were planted October 16th and others about a week later. It seems that the greatest injury is done to lupins sown early, and that if planting is deferred until the latter part of November very little damage will result from the attacks of this fly.

LAWSON CYPRESS BARK BEETLE (*Phlœosinus punctatus*).

During the past year our attention has been repeatedly brought to the sickly condition of many of our Lawson Cypress trees. This is one of our common and most handsome ornamental trees, and, therefore, the way in which they are dying is a matter of no small concern to many parties.

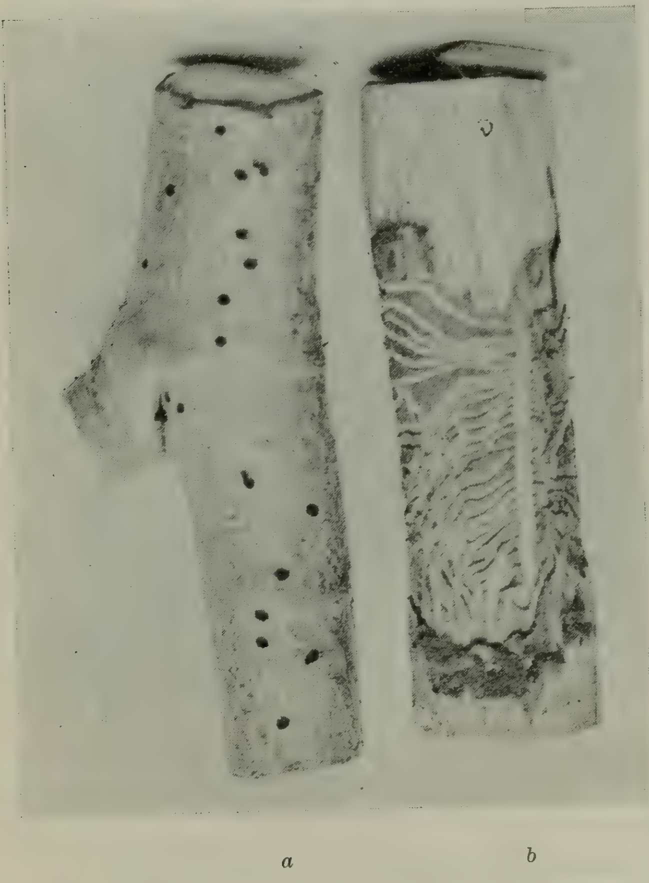


PLATE 8. LAWSON CYPRESS ATTACKED BY BEETLE.

The first indication one has that the tree is diseased is in the unhealthy appearance of the upper leaves; these turn brown and die, and gradually those below take on a similar appearance until they are all killed. If the trunk and branches are examined it will be noticed that they are thickly punctured with small holes (Plate 8, *a*). Then if some of the bark is cut it will be found to be dead in many places, especially near the top of the tree, not infrequently extending entirely across the branch. There will also be noticed small burrows just under the surface, and if it is in the winter there may usually be found at one end of each burrow a small white grub or dark brown beetle. This beetle is one of the Engraver Beetles, so called on account of the appearance of the system of burrows (Plate 8, *b*). The central tunnel is made in the sap wood by the mother beetle, which deposits eggs at frequent intervals. The larvæ hatching from these eggs bore off at right angles. When the beetles are numerous the trees are frequently encircled, so that the food supply is cut off. The attack is usually begun at the top of the tree and extends downward from year to year.

This family of beetles generally attacks trees that are not in a very healthy condition, although when they become very numerous they take to healthy trees. Such has proven to be the case with the Lawson Cypress Beetle. Those trees which have suffered most severely from drought lately have been most severely injured by the pest; while those in the same locality which have been kept thrifty are in many instances almost free.

After these borers have once gotten into a tree there is no way in which they can be killed without injury to the tree. Where the attack is severe the trees should be cut down and burned during the winter, while the insects are in their burrows. They begin to eat their way out as early as March, although some appear much later, hence the destruction should be done earlier than this. Trees only slightly affected need not be destroyed, since by fertilization with Chili saltpeter and frequent watering they may be gotten into such a healthy condition as to withstand, and in a measure resist, attack. Professor Hilgard has by this means saved some of his trees which were beginning to show marked signs of injury. Prompt measures should be taken against the insect, not only to save the trees attacked, but also to prevent the numbers from becoming so great as to cause them to spread to healthy trees.

An Oak Twig Wasp (*Andricus* sp.).

A serious enemy of the English oak (*Quercus pedunculatus*) is a very small gall wasp determined by Mr. William H. Ashmead as a species of *Andricus*, possibly European in origin. Were it not for the small wasp this tree would rank high as a timber, ornamental, and shade tree. Unlike most related forms the insect does not produce a gall. The eggs are laid in the smaller twigs, and the larvæ develop just under the bark. When fully grown, the wasp, which is about the size of and appears much like a common gnat, eats its way out. The favorite place of attack seems to be the nodes, although the internodes frequently contain several. Twigs badly attacked usually die back, causing others to branch out and thus resulting in knotty branches frequently so weakened that they are unable to bear the weight of the foliage. If the dead twigs are examined they will be seen to be full of small holes through which the insects have emerged.

During the winter the fully developed forms may be found in the twigs. These begin to appear with the first warm weather of spring. This year some emerged March 4th. Where they become abundant enough to be injurious, therefore, by rigorous pruning, cutting back about two years' growth, and burning the brush in the winter when they are all in the twigs, the numbers will be materially lessened and the trees allowed to make a good start.

THE WOOLLY APHIS OF THE APPLE (*Schizoneura lanigera*).

During the past year the customary number of requests for information concerning this pest has been received. The insect occurs all over the State. In some cases brought to our notice large numbers of badly infested young trees were being planted. By the time such trees come into bearing the roots will be a perfect mass of knots; these will later decay, so that the root-system will be largely destroyed, and if the trees are not killed outright they will become unprofitable. On the roots the aphids may be frequently seen as soft woolly insects, resembling and sometimes mistaken for a mold.

Badly infested stock should not be planted. That which is only slightly infested may be freed from the aphids at the time of transplanting by dipping the roots and lower part of the trunk in water kept at a temperature of 130° to 150° Fahr. Older trees may have their lives and productiveness prolonged by removing the soil from about the base of the tree and putting two to four pounds of tobacco dust near the crown and covering it up. This not only kills those aphids present, but also keeps others away.

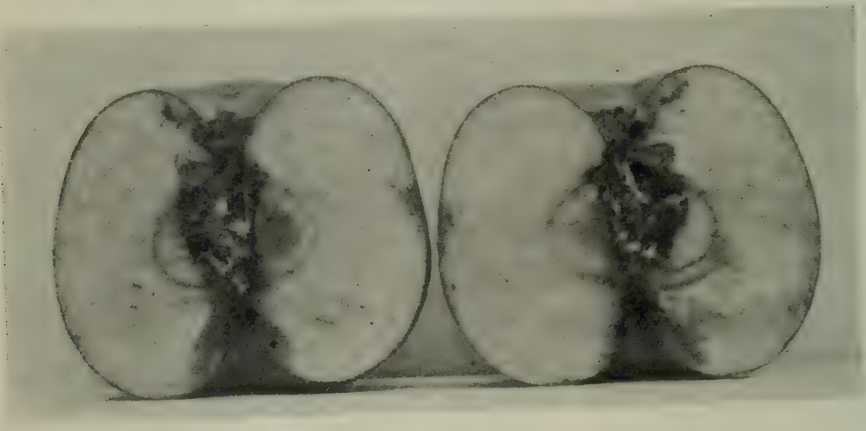


PLATE 9. WOOLLY APHIS (DEAD) IN APPLE.

The aphids also attack the branches and not infrequently the fruit during the later spring and summer. On the former they appear as cottony patches. To the latter the injury is twofold. Some attack the fruit in the stem end, injuring the stems and causing the apples to drop or be of inferior quality, while others in such varieties as have open calyx tubes enter the fruit through these. This is especially true of the Newtown Pippins. In some cases which we have examined the core was decayed somewhat as if it had been attacked by the codling-moth (Plate 9). Newtown Pippin apples received through the courtesy of Balfour, Guthrie & Co., from Pajaro Valley, Santa Cruz County, under date of December 10th, contained many of the live aphids. Others from Watsonville, February 8th, contained only dead specimens. It was claimed that the apples were not carrying so well as in former years. This may have been partly due to drought and exhaustion of the soil. A thorough spraying with kerosene emulsion as soon as the aphids make their appearance will not only result in an increase of salable fruit, but also protect the branches. The spray must be applied with considerable force, and preferably warm, to increase its penetrability.

NEMATODE WORMS.

Nematode worms, although not insects, yet deserve mentioning on account of their importance. Specimens are frequently sent in for examination. As the practice of growing vegetables under glass increases the injury caused by these almost microscopic worms will become more noticeable. Plate 10 shows the result of the attack upon tomato roots grown under glass by G. W. Hurtt, San Bernardino, Cal. The worms attack a great variety of plants, and working in the soil as they do, their control is a difficult matter. The sterilizing of the soil with steam as practiced in the East is an expensive operation. However, we believe that the desiccation method which is employed to a considerable extent in Europe will prove quite effectual in those portions of the State which have warm, dry summers. By thoroughly working the soil in the summer so that it will lose all the moisture possible, and then by applying unslaked lime at the rate of four tons to the acre, which assists still further in the drying of the soil and destruction of the worms, almost complete immunity should be had. The lime will also destroy such fungi as cause the club-root of cabbage, etc., which resembles more or less the work of the nematodes. But land so heavily limed will usually have to be left fallow for the season.

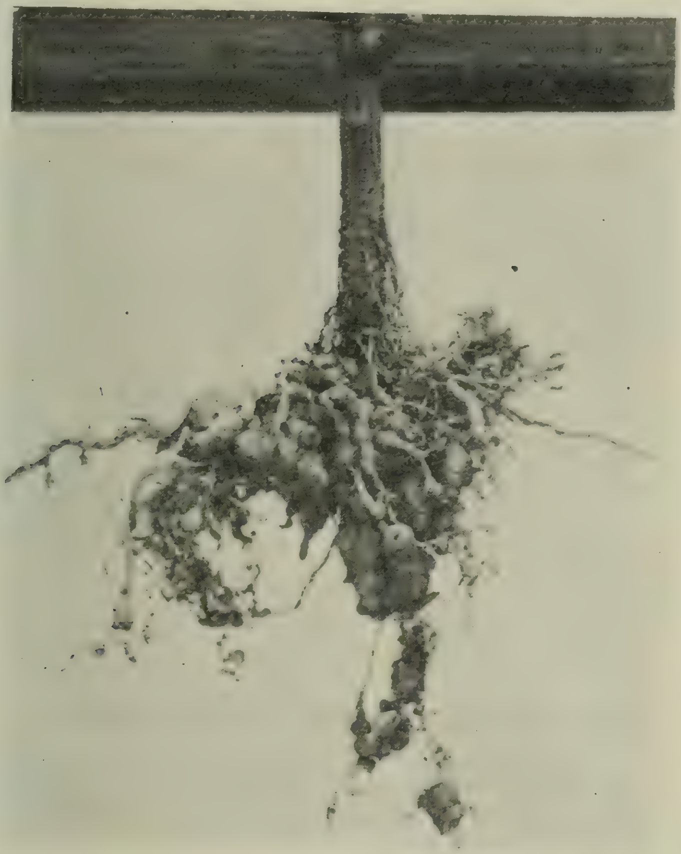


PLATE 10. TOMATO ROOTS ATTACKED BY NEMATODE WORMS.

SPRAYS AND WASHES.

Following are the sprays and washes mentioned in the above:

Name of Wash.	Ingredients.	For 5 Gals.	For 40 Gals.	Directions.
Paris Green	Paris Green	¾ oz.	6 oz.	Add the Paris green to the cold, strained lime water. Keep constantly stirring while spraying.
	Lime	8 oz.	4 lbs.	
Kerosene Emulsion	Kerosene	3 pints	3 gals.	Mix hot by pumping through a spray-pump for fifteen minutes, then dilute. Use either sour milk or soap solution. One-half as strong will do for plant-lice. Twice as strong is safe when the leaves are off. An emulsion is more easily made if about twelve times as much soap is used.
	Sour Milk	1½ pints	1½ gals.	
	or			
	Soap	1½ oz.	¾ lb.	
Rosin Soap	Rosin	1 lb.	8 lbs.	Boil two hours with a small quantity of water, then dilute with warm water. It may be used one-half stronger when the leaves are off. It is cheaper than the emulsion.
	Caustic Soda	¼ lb.	2 lbs.	
	Fish Oil	2 oz.	1 pint	
Lime, Salt, and Sulfur	Lime	3 lbs.	24 lbs.	Boil the sulfur with one-fourth of the lime for 1½ hours, or until the sulfur dissolves. Slack the rest of the lime and dissolve the salt in it; add this to the above and boil for half an hour longer; then dilute.
	Salt	1 lb.	8 lbs.	
	Sulfur	1½ lbs.	12 lbs.	

PARIS GREEN FOR THE CODLING-MOTH.

Bulletin No. 126 of this Station, on Paris green for the codling-moth, was issued in 1899, and is still available for distribution. The first part, by C. W. Woodworth, discusses the impurities in the commercial article, danger from arsenical adulterations, injury to foliage, and easy tests for purity; requirements for spraying purposes, laws concerning Paris green, standards of purity and quality, and the various substitutes used. Other methods of fighting the codling-moth are given, the mistakes commonly made, and the correct practices for treating the moth. The second part, by George E. Colby, gives the results of the examination of Paris green and some other arsenical spraying materials.

The results of this examination of Paris green and other arsenical spraying materials may be summarized as follows:

1. That many Paris greens nowadays contain large amounts of free water-soluble arsenious oxid, the manufacture and sale of which should be discontinued, both because these materials have proven injurious and unsatisfactory in horticultural work, and because they constitute a very obscure form of fraud upon the purchaser.

2. That the microscopic examination of a Paris green affords sufficient evidence for rejecting it if it contains as much as 6 per cent of free arsenious oxid; and above this figure there is no question of the great value of this rapid and excellent test.

3. That adulteration in the sense of added foreign matter to Paris green (e. g., barium carbonate, calcium carbonate, and sulfate) is rarely practiced in this country, at least by the manufacturers.

4. That the newer spraying materials, from the evidence at hand, with the exception of the very injurious barium compound and paragrene, will doubtless prove acceptable and cheap substitutes for Paris green, if the quantity of free arsenious oxid, especially in the Paris green one, is better governed by proper methods of manufacture.

[At the last session of the Legislature (1901) a law defining the maximum permissible content of free arsenic in Paris green at four per cent was passed and its execution assigned to the Experiment Station at Berkeley. The work done has already had the effect of bringing to the State greens fully within the above limit, and such can now be obtained from all large dealers. —E. W. H.]

MISCELLANEOUS.

THE CULTIVATED GUAVAS, AND THEIR BOTANICAL DIFFERENCES.

By Joseph Burtt Davy.

In view of the increasing interest which has recently been shown in the cultivation of guavas in Southern California, it has seemed expedient to prepare and publish a brief account of the genus, with a key to the species already introduced, by which they may be distinguished from one another.

The guavas belong to the genus *Psidium* (named from the Greek word "psidion," a pomegranate), and the order *Myrtaceæ* (Myrtle family), which also includes the well-known genera Eucalyptus, Myrtus, Callistemon, Calothamnus, Leptospermum, Angophora, Tristania, and Eugenia, and produces such useful articles of food as the clove, allspice, Brazil-nut, rose-apple, jambolan, and the various kinds of guava.

The genus *Psidium* includes about 130 species of trees and shrubs indigenous to tropical and sub-tropical America. Some species are now found wild in tropical Asia and South Africa, having been introduced and become naturalized. The genus is distinguished by the following characteristics:

Leaves opposite, petiolate, penniveined; flowers rather large, white, cymose on axillary or lateral one- to three- (rarely many-) flowered peduncles; calyx-lobes 4 or 5; petals 4 or 5, spreading; berries globose, ovoid, or pear-shaped, usually with a roughish skin and often crowned with the calyx-limb; seeds sub-reniform, hard.

Propagation is usually effected by cuttings of the young shoots which are getting a little firm at their base, inserted in sand under glass, with bottom heat. In setting out, care should be taken to provide perfect drainage, as the plants dislike stagnant water.

KEY TO THE SPECIES IN CULTIVATION.

A. Branchlets 4-angled.

1. *Psidium guayava*, L. (synonym: *P. guava*, Raddi). Lemon Guava. A shrub or small tree, 6 to 15 feet high; leaves oval to oblong-lanceolate, bluntish, chartaceous, glabrous above, puberulent below; peduncles three- to many-flowered, pubescent; fruit globose, yellow, aromatic, somewhat astringent. Flowering June. Native of Mexico, West Indies, and South America. Grown extensively in Southern California, and valued for jellies and preserves; several horticultural varieties are offered by nurserymen. For an illustration of this species, see Bailey's Cyclopedia of American Horticulture, vol. iv, p. 1461. It is much less

hardy than the Strawberry guava and is inferior to it in quality and usefulness (*Wickson*); the climate of Berkeley proves too severe for it.

Var. *sapidissimum*, Jacq., has fruit similar to that of the typical plant, but the peduncles are only one-flowered.

Var. *pyriferum*, L. (synonyms: *P. pyriferum*, L.; *P. pyriforme*, Griseb.). COMMON GUAVA. Small tree; leaves large, pale-green, acute; peduncles one-flowered; fruit small, pear-shaped, smooth-skinned, yellowish when ripe, aromatic, sweet and pleasant to the taste. Flowers May-July; fruits July-November. It has been figured in the Botanical Register, pl. 1079. This is the source of the well-known guava jelly of the West Indies; the fresh fruit is also edible, and is said to be most agreeable if gathered in the early morning; it is then more pleasantly acid than when gathered later in the day. When deprived of the small, stony seeds the fresh fruit makes excellent tarts. It is reported as having ripened fruit at Santa Barbara, where it has been used for making jelly. Also called the White or Pear guava.

Var. *pomiferum*, Hort. (synonym: *P. pomiferum*, L.). APPLE OR RED GUAVA.

There are numerous cultural varieties and crosses of the Common guava, in cultivation in tropical countries.

AA. BRANCHLETS COMPRESSED-CYLINDRICAL.

2. *P. polycarpon*, Lamb. PROLIFIC GUAVA. Shrub 3 feet high; branchlets pubescent; leaves elliptical or oval-oblong, chartaceous, puberulent beneath; primary veins costate, prominent beneath, the secondary ones reticulated and transverse; peduncles usually three-flowered; berries yellow, the size of a large cherry, and said to be of exquisite flavor. Flowering May. A profuse bearer. Native of Trinidad. Figured in the Botanical Register, pl. 653. Said to be superior to the Lemon guava in flavor and to be second only to the Strawberry guava.

AAA. BRANCHLETS TERETE (CYLINDRICAL).

3. *P. araca*, Raddi. BRAZIL GUAVA. Shrub 4 to 6 feet high, branchlets hirsute; leaves oval or oblong, obtuse, above sub-velutinous to the touch, beneath pubescently sub-hirsute; veins reticulate, somewhat raised; peduncles axillary, one- to three-flowered; fruit "very large," ovoid, greenish-yellow, flesh white. This species has recently been introduced by Dr. Franceschi of Santa Barbara, and is offered by him with the recommendation "said to be one of the very best guavas."

4. *P. guianense*, Pers. (synonyms: *P. guiniense*, Hort., and probably *P. guineense*, Swartz.). GUIANA GUAVA. Shrub 8 to 10 feet high; branchlets pubescent-villous; leaves ovate, glabrous above, petioles and under side rusty-tomentose; peduncles one- to three-flowered; fruit 1 inch in diameter, subrotund, puberulent, deep yellow without; flesh red, said to possess an exquisite flavor. Said to somewhat resemble the common guava in foliage, but having the leaves broader and shorter. *P. guineense*, of Swartz, a native of the West Indies, is considered by some writers to be synonymous with *P. araca* of Brazil.

5. *P. cattleianum*, Sabine. STRAWBERRY GUAVA. Shrub or small tree 10 to 20 feet high; branchlets glabrous; leaves obovate, roundish, leathery, dark-green, glabrous; peduncles solitary, axillary, opposite

one-flowered, scarcely equaling the petioles; flowers small; fruit nearly spherical, varying in size from that of a cherry to a small plum, fine deep claret-color, its skin tough, foveolate, resembling that of a ripe fig but thinner; pulp fleshy, soft, and juicy, purplish-red next the skin but white at center, with a strawberry-like fragrance and flavor, whence the popular name. Flowering May; fruits begin to ripen in October and last for several months. Native of Brazil. Figured in the Botanical Register, pl. 622; Curtis Botanical Magazine, pl. 2501; and Nicholson's Dictionary of Gardening, vol. iii, p. 238. Extensively cultivated in Southern California; hardy in sheltered places out of doors near San Francisco and doubtless far northward in the interior valleys, and ripening fruit at Berkeley and Sacramento. It seems to be about as hardy as the orange, and has fruited in widely separated parts of the State (*Wickson*). Sometimes called the Purple guava.

Var. *lucidum*, Davy (synonym: *P. lucidum*, Hort.). YELLOW STRAWBERRY-GUAVA. Has a larger yellow fruit, said to have a better flavor than that of the purple-fruited form. Reported as extensively grown in Florida. Introduced into Southern California by Franceschi; said to be very hardy and worthy of more extended trial. This may be the same as the so-called Chinese guava (*P. sinense*, Hort.; *P. chinense*, Hort.).

SPECIES INSUFFICIENTLY KNOWN.

P. guayavillas, Hort. "Brazil; a distinct looking species, said to have smaller fruit (than *P. guayava*) but of superior taste." Another species recently introduced by Dr. Franceschi. This may be the same as the *P. cuyavillas*, Burm., which has been considered a variety of *P. guayava*.

P. sinense, Hort. (synonym: *P. chinense*, Hort.), recently introduced by Mr. Swingle, Agricultural Explorer for the U. S. Department of Agriculture, has not yet been seen by us. As it is believed that there are no species indigenous to the Asiatic continent, unless, perhaps, in Cochin-China, it may be that this is a newly developed cultural race of *P. guayava*, of Chinese origin; or it may be identical with *P. cattleianum lucidum*; it is sometimes called the Yellow Cattley, Chinese, or Commercial guava, and is said to resemble the Cattley in its fruit, except that it is yellow and of larger size.

P. thea, Griseb., of Argentina, another of Mr. Swingle's recent introductions, has not yet been seen by us, and the published description is not accessible.

There is a large number of species indigenous to South America and the West Indies, among which several have been suggested as suitable for introduction into cultivation, and some of which might prove serviceable in breeding improved races of guavas. Probably the most important of these are: *Psidium acidum*, *P. arboreum*, *P. chrysophyllum*, *P. cinereum*, *P. cordatum*, *P. cuneatum*, *P. grandifolium*, *P. incanescens*, *P. lineatifolium*, *P. malifolium*, and *P. rufum*.

[NOTE.—The synonymy of the genus *Psidium* is in a state of great confusion, and is badly in need of thorough botanical revision.]

RECENT FERTILIZER EXPERIMENTS.

By Charles H. Shinn.

For two seasons at the several substations experiments have been carried on with fertilizers furnished in 1899 by the late Dr. John Myers, of the Nitrate Propaganda. These trials were nearly all with hay crops, on light soils, and directed as far as possible to the practical illustration, to the farmers of the district, of the profits of the intelligent use of commercial fertilizers.

NOTES FROM AMADOR SUBSTATION.

Former Experiments.—During the three years 1890–1, 1891–2, and 1892–3, fertilizer experiments were conducted at this substation on both the granite and the slate soils, but within the station tract. Here, on a very poor granite which normally yielded about a quarter of a ton of hay to the acre, the use of nitrate of soda and phosphate increased the yield of hay to one and a fourth tons the first year, and to one and a half tons the second and third years when only nitrate was applied. The crop on the slate soils was proportionately increased, rising to nearly three tons per acre, chiefly upon nitrates. The profit arising from the use of these fertilizers was manifest, but the plots were small and the results obtained were not as convincing as in the experiments of 1899–1900.

Soils.—The three leading soils of the Sierra foothills are: (1) those derived from a true granite; (2) those derived from the diabasic or "blue trap" rock; and (3) those derived from the slate "bedrock." The granitic soil is the highest and poorest; when coarse it is very unproductive. The second type, the trap soil, is fairly good, but shallow. The third, or slate, is the famous "red earth" of the miners, and it varies much in tint and quality, in depth and value. (See California Experiment Station report 1888–9, pages 54–78.)

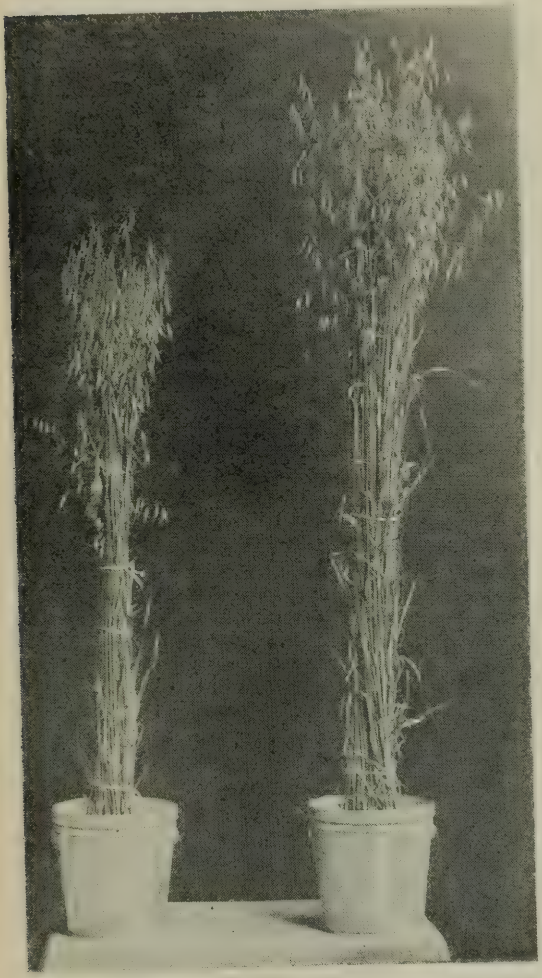
The season of 1900 was one of comparatively light rainfall and great summer heat at all the substations, but the season was more favorable in Amador than elsewhere. On the whole, the results of the tests made with nitrate of soda on the wheat plots in Amador County, near the substation, were remarkable, and produced a deep impression on the farmers there. The wheat, oats, and barley showed greatly increased valuation (*i. e.*, cash profit resultant from the use of the fertilizers).

The land used was a field a mile from the substation, rented for the purpose, as our own tract was otherwise occupied. It consisted in part of granite soil, in part of slate soil, none of it level, but very uniform in grade. It had been under cultivation for about twenty-five years, and was never "strong soil." The chief selling crop in the district is hay, for use of teamsters, and it averages about $15 per ton, one year with another.

Oats.—The soil was plowed deeply as early as possible and harrowed; the seed was drilled December 23, 1899; smoothing harrow was used later to break the top crust after rains.

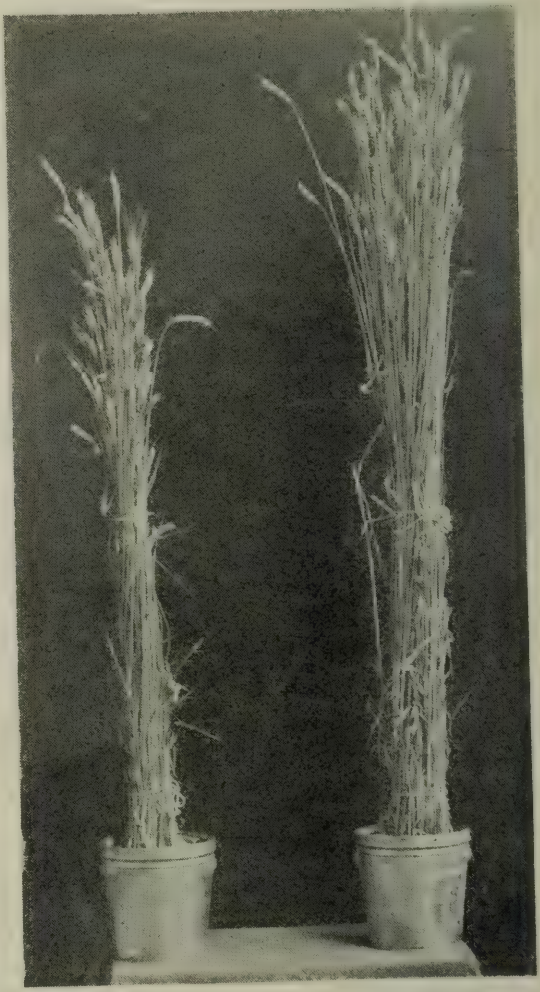
Check Plot.—One eighth of an acre; granite soil; northeast slope; no fertilizer. Seed was sown December 23, 1899, and hay cut May 30, 1900; weight green, at the rate of 6,093 pounds per acre; weight cured, at the rate of 2,400 pounds per acre.

Fertilized Plot.—Under same conditions as check plot. First top-dressing, applied March 1st, two days before a heavy rain, consisted of sodium nitrate at the rate of 175 pounds per acre, and muriate of potash at the rate of 128 pounds per acre. The crop in eight days appeared much darker in color than that of the check plot, and grew much better. Second application, made April 1st, followed by a rain, consisted of sodium nitrate at the rate of 85 pounds per acre, muriate of potash at the rate of 100 pounds per acre, and Thomas phosphate at the rate of 180 pounds per acre. Hay cut May 30th (as on check plot); weight green, at the rate of 11,927 pounds per acre; weight cured, at the rate of 4,995 pounds per acre.



Not Fertilized. Fertilized.

PLATE 11. SAMPLES OF OAT CROP OF 1900.



Not Fertilized. Fertilized.

PLATE 12. SAMPLES OF WHEAT CROP OF 1900.

This was by far the best oat crop in the region. The check plot yield of one and one fifth tons per acre was worth in the field, cured, not baled, $12 per acre; but the yield of a fertilized acre as shown was worth about $25. The value of the fertilizer used was about $10, leaving a profit of $3 resulting from its use. But according to former experience, the benefit of the phosphate would be much more manifest the following season, when only nitrates would be applied, reducing the cost of fertilizer to $5 or less per acre.

Barley.—Tested on slate soil, southeast slope; conditions much similar, except in exposure, to those of the wheat tests. The sowing, however, was three days later.

Check Plot.—One eighth of an acre; no fertilizer. Seed was sown November 1, 1899, and hay cut May 15, 1900; weight green, at the rate of 4,537 pounds per acre; weight cured, at the rate of 3,000 pounds per acre.

Fertilized Plot.—One eighth of an acre; conditions similar to the above. First dressing, applied March 1st, consisted of nitrate at the rate of 175 pounds per acre; application followed by a rain. The crop showed effects in six days. Second application of nitrate, at the rate of 85 pounds per acre, was made April 1st, and followed by a good rain. Weight of hay, green, was at the rate of 7,972 pounds per acre; weight, cured, was at the rate of 5,925 pounds per acre.

The market value per acre of such barley hay as that on the check plot, cured but not baled, was $13.50; the market value of the fertilized crop similarly reckoned was $26.66—a gain of $13.16. Since the market price of the fertilizer used was at that time $5.20 per acre, the profit from its use was $7.96. As in the case of the wheat, this was on land whose rental value does not exceed $2 per acre.

Not Fertilized. Fertilized.

Plate 13. Samples of Barley Crop of 1900.

Wheat.—The wheat grown was on red soil (slate), but not soil of first-rate quality or depth (see paragraph on soils). It was sown October 27th, on a southern slope. Seed was drilled; crust broken with smoothing harrow; tillage excellent.

Check Plot.—One eighth of an acre; no fertilizer. Seed was sown October 27, 1899, and hay cut May 29, 1900; weight green, at the rate of 5,450 pounds per acre; weight cured, at the rate of 3,815 pounds per acre.

The slate soil naturally produces more hay than does the granite, but two tons on such soil would be considered a very good crop. The average yield of the land has not exceeded one and a half tons; the good tillage therefore increased the crop.

Fertilized Plot.—One eighth of an acre, under conditions similar to the check plot. Fertilized March 1st with nitrate at the rate of 125 pounds per acre; followed by rain. In one week the field showed the effect most clearly. Second application was made April 2, 1900, at the rate of 85 pounds per acre; and followed by rain. Weight of hay green, at the rate of 8,575 pounds per acre; weight cured, at the rate of 6,295 pounds per acre.

The market value per acre of such hay as that on the check plot, cured but not baled, was $17.16. The market value per acre of such a crop as that on the fertilized plot was $28.33—a gain of $11.17. The cost of the fertilizer, if purchased in ton lots, was $4.20, leaving a profit of $6.97 caused by its use. Such land as this in the district would be considered well rented if the owner received $2 cash rent per acre per annum.

Notes on Experiments in 1900–1901.—In this season the areas used were restricted, owing to the necessity of taking room for other more important cultures. The check plot of one eighth of an acre on granite soil, unfertilized, sown to oats in January, 1901, crop cut May 30th, yielded 2,552 pounds of hay per acre; a very large crop for this soil, and showing a most favorable season.

The fertilized plot was given nitrate at the rate of 272 pounds per acre, Thomas phosphate at the rate of 480 pounds per acre, and muriate of potash at the rate of 128 pounds per acre. These excessive amounts were put on to determine whether growth was injured in any manner; but the yield when cut, May 30th, was 5,445 pounds of hay, or two and one eighth times the yield of the unfertilized plot. The price of hay was $14 per ton.

Larger plots, covering oats, wheat, and barley, have been laid out for the coming season, with a view to ascertaining the practical limits of profitable use of fertilizer on these granite soils.

NOTES FROM THE SOUTHERN COAST RANGE SUBSTATION.

The fertilizer experiments at the substation near Paso Robles were conducted with wheat, also on portions of the orchard and vineyard. These were the first experiments of the kind at that point. The land used had been under cultivation about twelve years and had never received any fertilization.

Wheat (on heavy soil).—This was on a fairly stiff adobe. The size of the plot was one eighth of an acre, the check plot being the same size. The land was plowed deeply October 25, 1899, and was sown broadcast with White Australian October 31st. It was harrowed well then, and again January 27th after a light rain.

The season was at first favorable, but two months of almost entire drought after January 3d checked the growth. There were severe frosts April 9th and 10th (27° and 28° Fahr.), which injured the wheat and materially lessened the yield.

Nitrate of soda was applied February 23d at the rate of 90 pounds per acre, and again the same amount on March 15th; total, 180 pounds.

Crops were cut for hay, May 25th. The yield of check plot was at the rate of 2,200 pounds per acre; yield of fertilized plot, at the rate of 3,340 pounds per acre.

A small portion of each plot was left to ripen grain, and the gain was notable here, as the unfertilized land yielded at the rate of six and a fourth centals per acre, while the fertilized plot yielded at the rate of nearly thirteen and three fourths centals. Six centals per acre was the average yield of winter-sown wheat in the neighborhood.

The gain made as regards *hay* crops on this land, by the application of $3.60 worth of nitrate per acre, was therefore something over half a ton, worth in the field, unbaled, about $5.50. The gain in yield of *grain* was greater, being over seven centals, worth about $7.

The foreman reports that the effect of the nitrate upon the growth of the wheat was very marked as soon as sufficient rain fell to dissolve the fertilizer, which occurred March 3d and 4th. By March 12th the results were noticeable as far as the plots could be seen, and were commented upon by visiting farmers. This rapid growth caused the fertilized plot to suffer more when the severe frosts came than did the unfertilized plot. This is a frosty locality, but in three seasons out of four fertilized grain would escape injury. It is probably fair to estimate the loss by reason of frost at 10 per cent. In ordinary seasons, or in many other localities in this district, the actual profit from nitrate on such soils might easily reach $2.45 and $3.40 per acre on hay and grain, instead of $1.90 and $2.40.

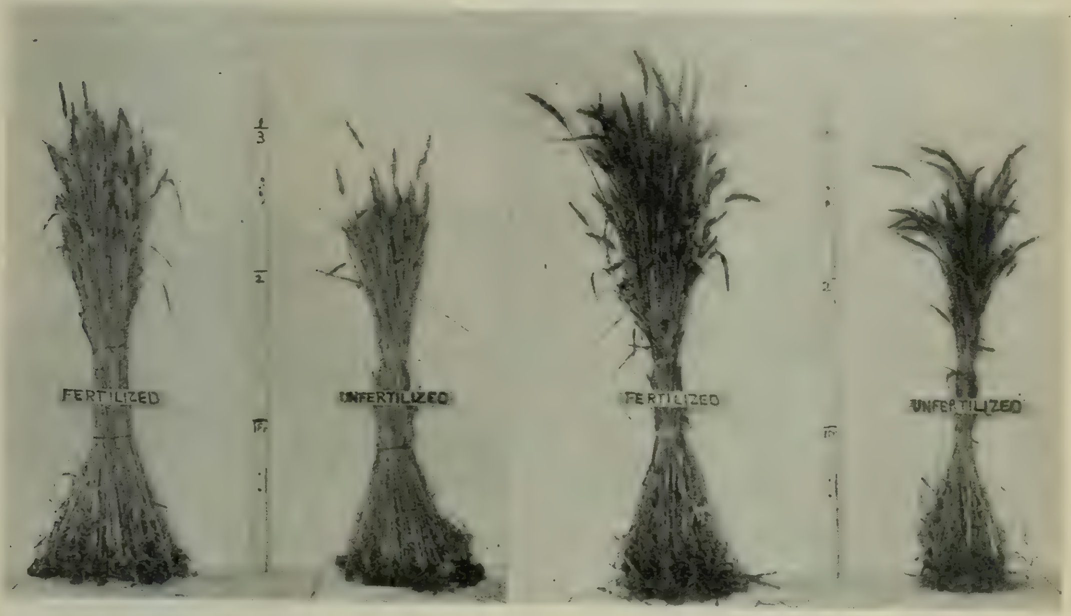


PLATE 14. FERTILIZED AND UNFERTILIZED WHEAT AT PASO ROBLES.

WHEAT (on light soil).—The plots here were of the same size, one eighth of an acre; the soil was the light granitic sand on hardpan, which is the "poor land" of the region. It was plowed November 15, 1899, and broadcast sown November 18th to White Sonora wheat. January 15th it was harrowed a second time to break the "rain-crust." Nitrate of soda was applied February 24th at the rate of 60 pounds per acre, and again March 15th at the same rate. May 12th the plot was cut for hay.

The yield of the plots was practically identical, a little over three quarters of a ton to the acre, or about the neighborhood average. The early gain in the growth of the fertilized plot was marked, but after the frosts this gain was lost. The heavy use of phosphates in addition to nitrates would have produced better results on this soil. But nitrate alone was so beneficial on this soil, as noted in the following experiment, that we are forced to conclude that the severe frosts and perhaps some differences in the depth of the hardpan under the two plots caused the failure.

THEISS WHEAT (on light soil).—Small plots of Hungarian wheat, "Theiss" variety, were drilled November 25th on this light granitic soil on hardpan. Nitrate of soda was applied February 24th, at the rate of 150 pounds per acre. Similar plots were treated as above, but sown broadcast. There were in each case unfertilized check-plots.

The severe April frost injured all the grain crop, rendering it useless for comparison, and more so on the fertilized plots. The yield of straw, however, stands as follows:

Drilled, on fertilized plot	8,337 lbs. per acre.
Drilled, on unfertilized plot	7,798 lbs. per acre.
Broadcast, on fertilized plot	7,487 lbs. per acre.
Broadcast, on unfertilized plot	5,615 lbs. per acre.

FERTILIZERS ON THE VINEYARD.—Two large plots were heavily fertilized, and check plots were used in each case. The soil was light granitic on hardpan. The vines had not penetrated the hardpan to any great extent, and were poor and stunted. The severe spring and early autumn frosts of several preceding seasons had much checked their growth.

Plot No. 1 covered a quarter of an acre, and the vines were set 8 by 8 feet. The vineyard was plowed March 12th, after the application of 13 ounces of Thomas phosphate to the vine, or at the rate of 550 pounds to the acre. Nitrate of soda at the rate of 8 ounces per vine, or 340 pounds per acre, was also applied before the rain. The check plot was adjacent, on the same rows and similarly cultivated, but without fertilizers.

The total rainfall for the season was only 11.66 inches. Early conditions were favorable, however, and April 9th the young shoots on the vines were a foot long; but at this date they were killed by frost. In some cases the spurs were destroyed, and in such cases the subsequent growth was entirely from the body of the vines. The crop was necessarily very light upon the vineyard.

Under these conditions the fertilizers applied showed very small results. On three of the ten rows the second growth was decidedly better on the fertilized portions. The value of the phosphates will undoubtedly be more noticeable another season, provided that the district escapes another severe frost.

The second vineyard plot of one quarter of an acre received the same amount of fertilizer, but applied a fortnight later. The culture was the same as in the previous case, and a check-plot was similarly continued along the same rows. In this case the vines, though cut back quite as badly, recovered on the fertilized plot noticeably better than on the unfertilized one.

APPLICATIONS ON ORCHARD.—Three plots, each of one eighth of an acre, were selected, each with an adjacent check plot.

Plot No. 1, peaches on light granitic soil with hardpan, received 32 ounces of nitrate of soda and 2 pounds 10 ounces of Thomas phosphate per tree. The nitrate was applied February 23d and March 19th; the phosphate March 1st. This made a total of 350 pounds of nitrate and 440 pounds of phosphate per acre. The trees showed greater vigor and better spring growth on the fertilized plot and set an unusually heavy crop of fruit, which was destroyed by the severe frosts. The growth of the fertilized trees continued later in the autumn.

Plot No. 2, apples and pears, young orchard, was fertilized for future results, receiving per tree 33⅓ ounces of nitrate of soda and 2 pounds 10 ounces of Thomas phosphate. It is expected that this quarter of an acre will receive such additional applications as seem hereafter advisable.

AUSTRALIAN SALTBUSHES.

The bulletin, No. 125, on the saltbushes, issued since the last report, is still available for distribution. It is divided into two chapters; the first, by C. H. Shinn, gives the results of eighteen years' tests, characteristics, propagation, and field experiments. These embrace the history of the introduction of the saltbushes into California, station and farm experiments, vegetative characteristics, propagation, the seed industry, saltbushes in other countries, and a description of some of the desirable saltbushes. The second chapter, by M. E. Jaffa, treats of the composition and food-value of the saltbushes as compared with other fodders. The composition of the ash is also given, to show the amount of mineral ingredients withdrawn by the crop.

The general conclusions are as follows: The *Atriplex semibaccata* is the most useful of the varieties tried; it grows on strong alkali land, furnishing a large amount of satisfactory pasturage and fodder; it thrives also on arid non-alkali uplands where the rainfall has been less than 5 inches, and where wells have to be sunk 200 feet to water; it is of easy and rapid growth and hardy under California conditions; tests indicate that it will endure a temperature below 14° Fahr. without injury.

Soils where the percentages of alkali are near the limit of tolerance can no doubt be sensibly relieved by planting saltbush and removing each cutting from the land; it is an excellent food for stock and seems to be readily eaten by them.

CENTRAL EXPERIMENT STATION.

Berkeley, Alameda County.

DISTRIBUTION OF SEEDS, PLANTS, CUTTINGS, ETC.

By Edward J. Wickson.

Plant introduction and trial, followed by distribution to local correspondents to secure wider data of adaptability and value, continue from year to year. Recently the work of distribution has been limited somewhat by continued drought in parts of the State where formerly most interest has been manifested. This interest will revive as more favorable conditions return. Introduction has increased and has been notably promoted by coöperation with the Department of Agriculture in this important undertaking of the Bureau of Plant Industry. The seeds thus introduced enter directly into our distribution, when sufficient quantity is secured, or local crops are grown on our own grounds to attain such amounts. We are still firm in the belief, stated in earlier publications, that our system of requiring participants to invest a nominal amount, to cover at least part of the cost of distribution, secures to us those who will make careful experiments and communicate results quite freely. In addition to the general offer by annual seed circular, there has been much done recently in furnishing larger amounts of seeds to selected correspondents who undertake to grow the experimental crops under the personal inspection of the Station officers.

The distribution by circular began more than twenty-two years ago, but its beginnings were small. The records of the distribution since 1886 furnish the following condensed review for the last sixteen years:

Ounces of Seeds Distributed.

	1886–97.	1897–8.	1898–9.	1899–0.	1900–1.
Cereals	21,896	--------	--------	2,104	2,064
Fiber plants	3,332	240	--------	--------	--------
Forage plants	30,602	769	2,207	2,831	658
Plants for green-manuring	5,948	384	864	2,410	450
Vegetables	12,729	689	4,043	2,399	1,013
Trees	4,628	1,726	1,084	1,869	552
Miscellaneous	4,353	76	172	--------	--------

Number of Plants and Scions.

	1886–97.	1897–8.	1898–9.	1899–0.	1900–1.
Trees (30 kinds)	6,938	--------	626	134	--------
Fiber plants	1,530	--------	--------	--------	--------
Forage plants (roots)	18,843	800	--------	--------	--------
Grapes, figs, and olives (cuttings and rooted)	48,190	4,397	590	895	--------
Mulberries and osier willows (cuttings and rooted)	13,105	--------	1,190	--------	--------
Miscellaneous	4,842	729	845	342	--------
Strawberries (10 kinds)	--------	--------	--------	2,649	--------

Since our last report, three seed bulletins have been issued, giving in detail the offerings for 1898–9, 1899–0, and 1900–1. The summaries of the last seven years, with classification of materials, amounts distributed, and the financial phases of the distribution, are given below:

NUMBER OF PLANTS AND CUTTINGS DISTRIBUTED.

Name.	1894–5.	1895–6.	1896–7.	1897–8.	1898–9.	1899–0.
Forage—						
Buffalo grass	--------	--------	--------	340	--------	--------
Jesuit's tea	43	--------	--------	--------	--------	--------
Flat pea roots	1,820	580	--------	270	--------	--------
Texas blue-grass roots	400	456	198	190	--------	--------
Sacaline	--------	174	--------	--------	--------	--------
Australian saltbush	--------	402	--------	--------	--------	--------
Paper mulberry	--------	318	--------	--------	--------	--------
Guavas (5 kinds)	--------	435	--------	--------	--------	--------
Grapevines—						
Persian (19 kinds)	1,358	1,733	2,803	1,022	--------	--------
Italian wine (43 kinds)	168	--------	--------	--------	--------	--------
Selected resistants (5 kinds)	--------	--------	23,345	3,375	590	895
Cañaigre roots	--------	--------	36	60	15	--------
Jerusalem artichokes (2 kinds)	--------	--------	912	590	830	--------
Silk cotton tree	--------	--------	35	--------	--------	--------
Olive cuttings (19 kinds)	699	--------	--------	--------	--------	--------
Sugar cane	76	200	--------	--------	--------	--------
Rhubarb	--------	--------	--------	79	--------	--------
Asia Minor willow	--------	--------	--------	--------	1,190	--------
South African cypress	--------	--------	--------	--------	260	--------
Northern Spy apple roots and scions	--------	--------	--------	--------	366	--------
Australian turpentine tree	--------	--------	--------	--------	--------	134
Strawberries (10 kinds)	--------	--------	--------	--------	--------	2,649
Early Dana potatoes	--------	--------	--------	--------	--------	342
Totals	4,564	4,298	27,329	5,926	3,251	4,020

WEIGHT, IN OUNCES, OF SEEDS DISTRIBUTED.

Name.	1894–5.	1895–6.	1896–7.	1897–8.	1898–9.	1899–0.	1900–1.
Cereals—							
Algerian wheat (16 kinds)	--------	--------	576	--------	--------	--------	--------
Wheats	544	800	--------	--------	--------	520	2,064
Rice	272	--------	--------	--------	--------	--------	--------
Nepaul barley	--------	2,256	--------	--------	--------	--------	--------
Buckwheat (5 kinds)	--------	432	--------	--------	--------	--------	--------
Oats (3 kinds)	--------	--------	--------	--------	--------	1,256	--------
Rye (Winter Ivanof)	--------	--------	--------	--------	--------	328	--------
Forage—							
Australian saltbushes	254	3,830	408	336	1,121	1,011	58
Saghalin polygonum	486	--------	--------	--------	--------	--------	--------
Modiola	--------	235	99	73	150	--------	--------
Orach	--------	47	--------	--------	--------	--------	--------
Khama melon	--------	--------	--------	--------	--------	388	--------
Dwarf rhagodia	--------	--------	--------	--------	--------	--------	15
Grasses—							
Awnless brome	--------	116	21	128	--------	--------	--------
Tall oat	53	170	84	68	--------	--------	--------
Schrader's brome	304	300	82	40	--------	--------	--------
Japanese wheat	360	180	42	--------	--------	--------	--------
Many-flowered millet	144	58	40	7	--------	--------	--------
Paspalums	112	172	120	8	--------	--------	62
Yellow oat	--------	--------	--------	26	--------	--------	--------
Teff	--------	--------	--------	27	--------	--------	--------
Crab	--------	--------	--------	9	--------	--------	--------
Texas millet	--------	--------	--------	11	--------	--------	--------
Tall grama	--------	--------	--------	15	--------	--------	--------

WEIGHT, IN OUNCES, OF SEEDS DISTRIBUTED—Continued.

Name.	1894–5.	1895–6.	1896–7.	1897–8.	1898–9.	1899–0.	1900–1.
Grasses—							
Various-leaved fescue	-------	-------	-------	16	-------	-------	-------
Fescues	-------	-------	-------	-------	81	-------	232
Eleusine	-------	-------	-------	-------	78	-------	-------
Hairy vetch	-------	-------	-------	-------	426	-------	-------
Iris pabularia	-------	-------	-------	-------	138	-------	-------
Sorghum (5 kinds)	-------	-------	-------	-------	213	382	-------
Russian millets (5 kinds)	-------	-------	-------	-------	-------	1,050	-------
Ray grasses (11 kinds)	-------	-------	-------	-------	-------	-------	291
Garden—							
Melde's perennial bean	226	394	-------	-------	-------	-------	-------
Irvine's hybrid perennial bean	244	380	-------	-------	-------	-------	-------
New Zealand spinach	85	212	-------	-------	-------	-------	-------
Sweet corn (2 kinds)	162	-------	1,140	160	674	351	-------
Kales	-------	-------	332	-------	-------	229	-------
Roselle	-------	-------	716	146	122	-------	-------
Edible-pod pea	-------	-------	447	186	248	-------	-------
Ceylon pea	-------	975	-------	-------	-------	-------	-------
New short white carrot	-------	-------	-------	83	111	-------	-------
Beans	-------	-------	-------	114	234	665	-------
Red Etampes pumpkin	-------	-------	-------	-------	248	-------	-------
Persian melon (10 kinds)	-------	-------	-------	-------	1,131	-------	-------
Vegetable marrow	-------	-------	-------	-------	91	-------	58
Peas	-------	-------	-------	-------	632	1,068	524
Soy bean	-------	-------	-------	-------	488	-------	-------
Big Hiller lentil	-------	-------	-------	-------	64	-------	-------
Parsley	-------	-------	-------	-------	-------	86	-------
Orach	-------	-------	-------	-------	-------	-------	29
Honcharenko watermelon	-------	-------	-------	-------	-------	-------	138
Khiva winter muskmelon	-------	-------	-------	-------	-------	-------	37
Windsor bean (5 kinds)	-------	-------	-------	-------	-------	-------	135
Kansas standard tomato	-------	-------	-------	-------	-------	-------	92
Green-manuring—							
Fenugreek	-------	-------	-------	348	444	-------	-------
Snail clover	-------	3,648	1,872	36	420	-------	-------
Square-pod pea (2 kinds)	-------	81	138	-------	-------	-------	-------
Crimson clover	-------	201	-------	-------	-------	-------	-------
Lupins	-------	-------	-------	-------	-------	1,328	384
Vetches	-------	-------	-------	-------	-------	677	66
Russian field pea	-------	-------	-------	-------	-------	405	-------
Sundry—							
English oak acorns	-------	252	-------	-------	-------	-------	-------
Eucalypts (13 kinds)	-------	-------	1,229	815	-------	403	84
Carob	-------	-------	908	-------	-------	-------	-------
Flax (5 kinds)	-------	752	-------	96	-------	-------	-------
Rose poppy	-------	199	-------	-------	-------	-------	-------
Tobacco (35 kinds)	-------	941	661	-------	-------	-------	-------
Tree tomato of Jamaica	264	-------	-------	-------	-------	-------	-------
Cañaigre	192	-------	68	76	-------	-------	-------
Cotton	-------	-------	-------	144	-------	-------	-------
Acacias (5 kinds)	-------	-------	-------	310	-------	185	201
Miscellaneous trees (14 kinds)	-------	-------	-------	601	1,084	-------	-------
Red-flowered passion vine	-------	-------	-------	-------	164	-------	-------
Black kurrajong	-------	-------	-------	-------	-------	-------	69
Araucarias	-------	-------	-------	-------	-------	894	-------
Bellota	-------	-------	-------	-------	-------	-------	80
New Zealand oil-tree	-------	-------	-------	-------	-------	155	118
English holly	-------	-------	-------	-------	-------	121	-------
Tagasaste	-------	-------	-------	-------	-------	111	-------
Totals	3,702	16,631	8,983	3,884	8,370	11,613	4,737

Financial Statement for Eight Years.

	1893-4.	1894-5.	1895-6.	1896-7.	1897-8.	1898-9.	1899-0.	1900-1.
Receipts.								
Cash from applicants	$323 63	$296 80	$476 62	$407 27	$213 39	$310 83	$393 97	$103 79
Assistance from Agr. Dept. of Univ.	12 00	41 00	23 50	--------	19 00	--------	--------	--------
Total receipts	$335 63	$337 80	$500 12	$407 27	$232 39	$310 83	$393 97	$103 79
Expenditures.								
Packing material for seeds	$5 00	$13 55	$25 80	$12 70	$11 00	$12 30	$17 05	$4 70
Packing material for plants	28 35	21 35	27 15	48 30	22 60	15 85	27 15	--------
Postage, cartage, etc.	75 34	68 00	148 21	100 41	61 20	66 38	106 98	24 52
Stationery	6 90	4 90	13 55	13 28	6 23	7 90	7 15	7 20
Wages	156 01	163 24	251 25	219 02	*123 38	*190 40	212 23	67 33
Total expense	$271 60	$271 04	$465 96	$393 71	$224 41	$292 83	$370 56	$103 75
Cash (unfilled orders) returned	64 03	66 76	34 16	13 56	7 98	18 00	23 41	04
	$335 63	$337 80	$500 12	$407 27	$232 39	$310 83	$393 97	$103 79

* $30.80 of amount due in 1897-8 was paid in 1898-9.

Extent of Distribution for Ten Years.

	1891-2.	1892-3.	1893-4.	1894-5.	1895-6.	1896-7.	1897-8.	1898-9.	1899-0.	1900-1.
Number of applicants	438	410	578	925	1,477	1,169	637	846	995	337
Packages sent by mail	612	517	761	1,163	2,027	1,446	861	984	1,566	381
Packages by express	46	124	56	12	54	171	81	43	------	------
Offices	267	225	329	382	486	427	302	360	436	197
Counties reached	47	46	48	53	54	52	51	52	52	48

REPORTS ON VARIOUS SEEDS AND PLANTS INCLUDED IN THE UNIVERSITY DISTRIBUTION.

By Edward J. Wickson.

Those who receive seeds or plants from the Station assume the obligation of reporting the results of their trial. The obligation is not discharged as fully as is desirable, and yet very interesting and important data are secured in this way. It is possible that this publication may suggest to some readers that they also have experience and observation in the same line which they should communicate to us. Sometimes the most important conclusions are secured through these deferred reports, because they cover long periods of time and, especially in the growth of trees, enable the correspondent to give measurements which determine not only the adaptation of the plant, but also its rate of growth or productiveness. Let it be understood, then, that it is never too late to make a report upon perennial plants.

It is impossible in the space which can be properly given to this branch of the Station work to include all the reports which we receive, but care is taken in condensation to reflect fairly the diverse phases which arise in the experience of different experimenters. Selection has to be made also of those plants whose characters and behavior seem to be most clearly made out.

TREES AND SHRUBS.

THE PAPER MULBERRY (*Broussonetia papyrifera*).—This tree is indigenous to the east coast of Asia and the Pacific islands. As pointed out in our last report, the tree is not a mulberry, though it resembles it in foliage. It is one of the sources of material used by the Asiatics in making paper-cloth, as the bark of the young shoots yields a strong fiber. In our last report a number of results are given showing that the tree is not suited to very frosty situations. It seems to be about as hardy as the orange. The following indicates its growth in a somewhat protected situation in the bay region:

J. J. Chappell, San Francisco, San Francisco County.—The Paper Mulberry, planted in 1899, three miles southwest of Menlo Park, on land that had reddish top soil and red subsoil, measures 33 inches in circumference and 22 feet in height.

THE ASIA MINOR WILLOW (*Salix salmoni*).—The distribution of this tree was decided upon on the basis of its exceptional growth at the University forestry station near Chico, where it proved the strongest-growing willow of 36 varieties. Cuttings planted in 1895, grown ten months in nursery, then transplanted to permanent place, were thirty-two feet high in October, 1897, with trunks of twenty-two inches circumference. The well-known *Salix alba*, under similar conditions, was twelve feet high, with a trunk of eight inches in circumference. *Salix salmoni* resembles *alba*, but its rapid growth makes it much more desirable. The following are observations of our correspondents:

B. H. Brubaker, Corning, Tehama County.—Asia Minor Willow cuttings made a growth of six feet in one year.

W. C. Bradford, Arbuckle, Colusa County.—The Asia Minor Willow has, during its first summer, grown about eight feet with no extra care.

N. A. Griffith, Trenton, Sonoma County.—The Asia Minor Willow cuttings have done splendidly. Eight out of nine cuttings lived and attained a height of five feet the first year.

Grant Wallace, Pomelo, Sacramento County.—Asia Minor Willow made a growth of from five to seven feet the first year.

A. J. Sharpe, Acampo, San Joaquin County.—Asia Minor Willows are growing well.

T. E. Rice, Livermore, Alameda County.—Asia Minor Willow made a good growth.

Mrs. L. A. Walker, Berkeley, Alameda County.—The ten cuttings all grew, and in a year's time the tallest plant measures from the ground seven feet six inches; the shortest, two feet six inches. They have not yet dropped their leaves.

William N. Russell, Los Gatos, Santa Clara County.—Asia Minor Willows did not do as well for me as the cuttings of the common willow set out at the same time. The cuttings made only about one foot of growth, possibly because they were shaded too much, as they were set near the edge of the creek and the banks are high.

Thomas W. Cowan, Pacific Grove, Monterey County.—All cuttings of Asia Minor Willow rooted, and will make nice plants.

H. B. Congdon, Tulare, Tulare County.—Asia Minor Willow grows well in moist location. Have one, grown from a slip the size of a pipe-stem last season, now twelve feet high. Well branched. The hot sun does not affect it, nor does a light freezing.

EUCALYPTUS SPECIES.—Although some parts of the State, notably the southern counties, have made commendable progress in distribution of eucalyptus species, it may be truly said that Californians generally only know a few of the species which were distributed through the nursery trade many years ago. At the University forestry station at Santa Monica a number of the less known species have been bearing seed for several years and have furnished material for distribution, which has brought trees into the possession of those who might not otherwise obtain them, and thus wider experimental data of the desirability and adaptability of the species will be secured. The distribution is too recent to allow anything more than preliminary statements, but these are in some cases determinative of local hardiness. The earlier reports of the Station contain data of the behavior of the species at Santa Monica. The following are brief descriptions, based upon this observation, of the species which are mentioned by correspondents:

E. ficifolia.—The well-known scarlet or crimson-flowered eucalypt. Regular, symmetrical habit; rather pyramidal form. Leaves large, ovate-lanceolate, pointed, dark green, coriaceous. Flowers large, brilliant red (varying from crimson to scarlet on different trees), in large terminal clusters; August, September. Seed capsules large, ovoid, in heavy clusters; remarkable. Fine ornamental tree.

E. calophylla.—Well-formed tree of regular, symmetrical outline, and rather pyramidal form. Leaves ovate to ovate-lanceolate, pointed, dark green, glossy. Flowers large, white, in large clusters, very conspicuous; August, September, October. Seed capsules large, urn-shaped, remarkable. Bark cinnamon colored, persistent. Wood valuable—strong and light. Fine ornamental and shade tree.

E. citriodora.—Rather slender, straight-stemmed tree, with long, slender, drooping branchlets, and long, narrow, sickle-shaped, bright green leaves. Flowers creamy-white; May, June, July. Bark deciduous in flakes, smooth, beautifully colored in pale gray and lavender tints. Leaves exquisitely lemon-scented, retaining the perfume when dried. A beautiful and very desirable ornamental.

E. cornuta var. Lehmannii.—Displays tendency to divide into several stems at or near ground, making a spreading tree. Leaves small, oblong, thick in texture, dull-green. Flower buds very large, resembling close clusters of horns; flowers in large, globular heads of apple-green filaments; fruit in large, close, spiny clusters; all very remarkable. Blooms July, August, September. Valuable as an ornamental and as a botanical curiosity.

E. cornuta.—Much larger and more rapid growing than the var. *Lehmannii*, but has something of same tendency to divide at or near the ground in many cases. Leaves lanceolate, dull-green, but shining in sunlight. Flower buds, flowers, and fruits like the last mentioned, but smaller, and the fruit clusters less compact. Blooms about same time. A fair shade tree; timber valuable.

E. Gunnii is one of the hardiest of the genus, and the sap is said to be used by Australian settlers to produce a fermented drink resembling cider. It makes a fair sized tree at Chico.

The following are the notes of experience in growing the above from seed and observations upon their hardiness as seedlings:

George B. Pearce, Paradise, Butte County.—Eucalyptus citriodora, though two feet high, was killed to the ground by frost.

G. P. Rixford, Sausalito, Marin County.—Eucalyptus citriodora, sent me three years ago, has done well and never suffered from the frost. *Eucalyptus ficifolia* trees are doing well and have blossomed three times, the first time the fourth year. The blossoms are very beautiful. The seed requires two or three years to ripen.

U. C. Bradford, Arbuckle, Colusa County.—The Eucalypts will not stand the frost. All were killed last year except Lemon-scented, though it was cut to the ground. It grew from the root this year to a height of six feet, but the leaves are now killed, although I think the body is alive.

L. L. Guss, Oakley, Contra Costa County.—Eucalyptus calophylla was killed at 24°; *E. Gunnii* was not injured. *E. citriodora* is a frail looking tree, but stands some frost. It grew four feet the first year and branched well.

Charles W. Bingham, Lakeport, Lake County.—*Eucalyptus calophylla* germinated and grew slowly during the warm weather, although kept well watered; but with the cooler autumn weather it began to grow better, branching freely and growing vigorously in the open air, unprotected.

C. P. Fairchild, Campbell, Santa Clara County.—The *Eucalyptus calophylla*, although protected, seems to freeze nearly every winter, so as not to gain much in height.

E. A. Stillman, Mendota, Fresno County.—The Eucalyptus seeds came up, but did not stand transplanting. It seems too hot and dry for any variety of Eucalyptus here.

E. F. Angus, Creston, San Luis Obispo County.—I raised about sixty plants of the *Eucalyptus Gunnii.* They made an excellent growth.

B. K. Brant, North Ontario, San Bernardino County.—Report of last year's seeds received from you. In the packet marked Scarlet-flowered Eucalyptus were two seeds. Both grew. One plant is now seven feet high, the other as many inches. From the seed of the Lemon-scented and Apple-scented gums I got all the plants I wanted and some for the neighbors. They have done well.

F. W. Bradley, San Diego, San Diego County.—*Eucalyptus calophylla* and *cornuta* var. *Lehmannii* grow well and appear to be thrifty.

ACACIAS.—Several species of acacia have recently been widely distributed by means of seed grown at the Santa Monica station, and on the basis of their success there and in other University plantations, are strongly commended. The species recently distributed are the following:

Acacia decurrens.—The well-known "Black Wattle" tree of Australia, a medium-sized tree of rapid growth, with beautiful fern-like foliage and brilliant yellow blossoms. The wood is of some value for use in the arts, and makes excellent fuel, but the principal value of the tree lies in its bark, which is very rich in tannin and is extensively used for tanning purposes.

A. decurrens var. normalis (?).—Differing from the above mainly in the greater beauty and delicacy of its foliage, which in decorative effect may be, not inaptly, compared to that of the asparagus fern. This variety blooms more freely, also, than the above, and its general appearance is much more ornamental.

A. melanoxylon (Blackwood Acacia).—An upright, symmetrical, pyramidal tree, with dense foliage. Very neat and trim in appearance, making an excellent sidewalk tree. Wood makes first-class fuel, and also valuable timber for many purposes. Grows rapidly.

A. pycnantha (Golden Wattle).—A medium-sized or small tree, well branched, with heavy foliage, and dense clusters of beautiful yellow flowers, borne very profusely in spring time. Bark also very valuable for tanning purposes. Tree of rapid growth, but often suffers from breakage by wind. Very ornamental when in bloom.

A. cyanophylla (Blue-Leaved).—Low-growing, spreading tree, adapted for parks and lawns. Leaves long and narrow (sometimes nearly a foot in length), bluish. Flowers larger than those of acacias mentioned above, of a rich orange color, borne profusely along the branchlets; very showy. Bark also useful for tanning.

The following notes from correspondence relate chiefly to the hardiness of seedlings:

H. A. Mark, Eureka, Humboldt County.—I sowed half of the Broad-Leaved Wattle seed on sand dunes and half in my garden. On the sand the little trees appeared and quickly died; in the garden they attained a height of two feet the first summer. I am satisfied that the only way to establish the wattle is to grow trees for transplanting upon the sand.

Charles W. Bingham, Lakeport, Lake County.—*Acacia cyanophylla* grew thriftily all summer and still continues to do so, and the best specimen measures 50 inches with two side branches each 24½ inches. The second best measure is 47 inches with branches 20 inches. *A. pycnantha*, like *E. calophylla*, has grown best since the cool weather began in October, and the best specimen measures 26½ inches, and is now growing thriftily in the open and unprotected.

R. P. Brandt, Fishrock, Mendocino County.—*Acacia decurrens* is a very rapid grower, a specimen in dry hillside soil growing eight feet a year for awhile, and attaining a height of over thirty feet.

L. L. Guss, Oakley, Contra Costa County.—Blue-leaved Wattle made a growth of one foot, but suffers more or less from frost at 24° Fahr. Broad-Leaved Wattle will stand 24° after the second year, but needs protection the first year. *Acacia pycnantha*, at this temperature, was badly frozen; and *Acacia lapantha* was killed to the ground. These were small plants, one to three feet high.

C. D. Guilford, Creston, San Luis Obispo County.—Blue-Leaved Acacia seems half hardy as to frosts, but resists drought well. The tree is in the center of a saltbush bed, but made a fair growth.

E. F. Angus, Creston, San Luis Obispo County.—The *Acacia cyanophylla* and *pycnantha* grow well, but will not stand the frost.

J. E. E. Nichols, Pomona, Los Angeles County.—*Acacia decurrens* var. *normalis* is a beautiful tree.

SALLYWOOD OF LORD HOWE ISLAND (*Lagunaria Patersonii*).—A small, compact, evergreen tree, of regular, pyramidal form. Leaves ovate, light dull green in color. Flowers large, waxen, bell-shaped, pink to white, very fine, and borne very profusely in July and August. Seed pods plump, pale yellow, downy, conspicuous, afterward shriveling and turning a dingy-brown color. A desirable ornamental for the shrubbery or home garden. The following indicate early results of the distribution:

George B. Pearce, Paradise, Butte County.—Sallywood was killed at a temperature of 20° above zero.

L. L. Guss, Brentwood, Contra Costa County.—Sallywood is very easily grown here, and so far does well.

Grant Wallace, Pomelo, Sacramento County.—Sallywood is easily grown. I have about eighty trees from one package.

C. D. Guilford, Creston, San Luis Obispo County.—Sallywood is doing nicely without irrigation. I have three fine trees; hardy as to sun, drought, or frost.

Thomas W. Cowan, Pacific Grove, Monterey County.—Sallywood has come up well, and the plants are now from three to four inches high.

THE ENGLISH OAK (*Quercus robur*).—The desirability of this tree and its character as perhaps the most rapidly growing hardwood tree thus far tried in California, have been fully set forth in our earlier reports. The following later observations are interesting:

G. P. Rixford, Academy of Sciences, San Francisco.—The English Oaks received three or four years ago, and planted in rather good sidehill soil at Sausalito, have done well without irrigation, except the first year, and with but little cultivation. Several of them are ten to twelve feet high and three to three and a half inches in diameter.

W. C. Bradford, Arbuckle, Colusa County.—The English Oaks which I planted seven years ago have their crop of large acorns every year.

Robert Hastie, Clayton, Contra Costa County.—My English Oak did well this summer. It made four feet seven inches, and the branches three feet four and three fourths inches.

B. D. Vanderburgh, Selma, Fresno County.—Three out of five English Oak trees died, but the other two are alive and doing well, never having been injured by frost. They are eleven inches in diameter, thirty feet high, with a spread of twenty-four feet, and have borne a heavy crop of acorns every year for several years.

ARAUCARIAS.—There are many interesting exotic trees and shrubs on the Flood Estate at Menlo Park which recently became the property of the University by gift of Miss Flood. Two species of Araucaria are represented by several specimens of exceptionally large size. They are elegant conifers, whose peculiar branching and evergreen foliage render them striking objects in city parks and suburban residence grounds in various parts of the State. Seed of these two have been distributed, viz.: Brazilian Araucaria (*A. brasiliensis*) and Monkey-Puzzle Araucaria (*A. imbricata*). The following are early observations upon the adaptations of the species:

Albert F. Etter, Briceland, Humboldt County.—The Araucarias are doing well.

R. P. Brandt, Fishrock, Mendocino County.—The Araucarias are about as unpromising as the Acacias are promising, but they may require a few years to start, as our coast pines do.

J. O. Titlow, Alameda, Alameda County.—The two Araucarias are making good growth.

William H. McKeany, Irvington, Alameda County.—I have twenty-four Araucarias (Brazilian and Monkey-Puzzle) six inches to one foot high, that have done exceedingly well.

J. E. Richard, Ceres, Stanislaus County.—The Brazilian Araucarias grew well, but the "Monkey-Puzzle" died, apparently not being able to stand the hot weather. I have several fine specimens of Brazilian, which unprotected have gone through the past cold snap without injury.

C. C. Wulff, Watsonville, Santa Cruz County.—Brazilian Araucaria is growing finely.

C. D. Guilford, Creston, San Luis Obispo County.—The Araucarias (Brazilian and Monkey-Puzzle) are doing well. I value them both highly.

E. F. Angus, Creston, San Luis Obispo County.—I have sixteen fine, strong plants of the Brazilian Araucaria and nine of the Monkey-Puzzle Araucaria, which I am quite certain will do well in this locality.

F. Ferguson, Santa Ana, Orange County.—The Araucarias did very well.

John Haw, El Modena, Orange County.—The Araucarias (*brasiliensis* and *imbricata*) are from eighteen to twenty-four inches high and are doing well.

F. W. Bradley, San Diego, San Diego County.—I have fifteen plants of the Brazilian Araucaria growing nicely; and they are much admired by all who see them.

NEW ZEALAND OIL-TREE (*Alectryon excelsum*).—The only species of the genus; habitat confined to New Zealand. A lofty and handsome evergreen tree with glossy, compound leaves and abundant, showy seeds in large scarlet arils. The oil of the seeds was used by the Maories of New Zealand. Time enough has not elapsed since distribution to widely determine the adaptability of this tree to California conditions.

Mrs. Wenonah Stevens Abbott, Oak, Shasta County.—All the seeds of the New Zealand Oil-Tree germinated, though two came through the soil without the central bud and still stand with only the cotyledonous leaves. The other three are growing well.

George B. Pearce, Jr., Paradise, Butte County.—I have several nice, sturdy little seedlings from the seed of the New Zealand Oil-Tree sent me.

Albert F. Etter, Briceland, Humboldt County.—Seeds of the New Zealand Oil-Tree germinated, but for some cause all dwindled and died before autumn.

Edith Waterman, Alameda, Alameda County.—I received a few seeds of the New Zealand Oil-Tree last winter, from which I have three plants six inches high.

William H. McKeany, Irvington, Alameda County.—I have five New Zealand Oil-Trees five inches high that have made a very satisfactory growth.

C. W. Wulff, Watsonville, Santa Cruz County.—The New Zealand Oil-Tree is making a fine growth.

John Haw, El Modena, Orange County.—The New Zealand Oil-Tree is very handsome. It is a slow grower.

THE TREE TOMATO (*Solanum betaceum*).—Later experience with this plant, which was quite fully described in our report for 1894-5, confirms the earlier conclusion that it is too subject to frost injuries to be satisfactory for either ornament or fruit-bearing, except in strictly thermal situations. It seems to be about as tender as the lime. The following are recent reports:

L. E. Darling, Dimond, Alameda County.—The Tree Tomato, which is two years old, is four feet high and full of green fruit, a few ripe ones, and blossoms that scent the whole yard. The fruit does not seem very good to eat, but is quite ornamental.

William Beauchamp, San José, Santa Clara County.—My Tree Tomato grew fine this summer, but has frozen down this winter. It bloomed, but set no fruit. I hope to have better success another year.

Robert Hastie, Clayton, Contra Costa County.—My Tree Tomato is doing finely. It is full of fruit, some of which is ripe. Last year it froze on the 24th of November so the fruit did not ripen. The frost killed all the branches, but did not hurt the main stem.

NEW EUROPEAN STRAWBERRIES.

A collection of new strawberries of English and French origin was secured by Mr. J. Burtt Davy, Assistant Botanist of this Station, during a trip abroad in January, 1898. The characters disclosed by their fruiting on the grounds at Berkeley seemed to warrant wider trial of the varieties, and the following were distributed:

1. Steven's Wonder.
2. Scarlet Queen.
3. St. Joseph (perpetual).
4. Commander.
5. Royal Sovereign.
6. King of the Earlies.
7. Louise Gauthier.
8. Monarch.
9. Sensation.
10. President Carnot.

More than 2,600 plants were sent out during the winter of 1900, of which interesting preliminary reports are now being received. Later observations are earnestly requested from all who received the plants:

B. H. Brubaker, Corning, Tehama County.—Steven's Wonder strawberry is a rather poor producer. The plants are covered with rust. The berries are very large. The Royal Sovereign is very good; plants healthy and prolific; berries good size. King of the Earlies is fairly good. The Monarch and Sensation are very much alike; very heavy-set plants, with abundant supply of very large berries, but rather coarse-grained and hard to part from the stem. All the plants have been bearing continually for three months.

George B. Pearce, Jr., Paradise, Butte County.—Most of the new European strawberries did well, though only three or four kinds fruited, and the berries were rather small. Of those that fruited Sensation proved the best, as they were indeed fine.

A. F. Etter, Briceland, Humboldt County.—I have had your French and English varieties of strawberries under observation for several years, but am not ready yet to make final report. Last season was not a favorable one in this region for strawberries. There were two severe frosts—one on Easter and one a week later, when the temperature fell to 26°. These European varieties lost their blossoms—all except the smallest buds. My own berry, the "Rose of Ettersberg," which I produced several years ago by grafting a large, white, little-leaved berry with pollen of a third-generation Sharpless × Parry seedling, lost one half of its blossoms. I used this berry as a standard for comparison, as it is the hardiest known to us. None of these Europeans appear now (March 1) to compare in general vigor and thriftiness with the "Rose of Ettersberg." In fruiting quality I would put the Europeans in this way: President Carnot, Royal Sovereign, Louise Gauthier, Scarlet Queen. In drought-resisting qualities they stand: President Carnot, Louise Gauthier, Royal Sovereign, Scarlet Queen, Steven's Wonder, Monarch, St. Joseph, Sensation. I have over five hundred to one thousand seedlings of Rose of Ettersberg, President Carnot, Louise Gauthier, and Royal Sovereign just coming up, and in the course of a few years I expect to get some very fine berries. The Rose of Ettersberg seems to produce much variation in its seedlings. I have been breeding strawberries on and off for the last dozen years.

Robert Hastie, Clayton, Contra Costa County.—St. Joseph and Scarlet Queen strawberries did fairly well, put out some runners, and stand drought better than other varieties..

A. C. Hull, Santa Rosa, Sonoma County.—Scarlet Queen had fine looking berries, but they were small. King of the Earlies had small fruit with good color; prolific. Sensation was very prolific, fruit large, but deficient in color.

O. B. Dobson, Lodi, San Joaquin County.—King of the Earlies, planted on light, sandy loam, well fertilized and irrigated, was especially high flavored, though small. Steven's Wonder has given good satisfaction. Royal Sovereign was also very good. Last year was unfavorable to strawberries here, on account of frost and hail.

J. E. Richard, Ceres, Stanislaus County.—The Sensation is very prolific; berries are large, heart-shaped, quite pointed, uniform in size, shape, and color, also of excellent quality. Scarlet Queen bears well; is not quite so large as the Sensation, but of good size, bright color, firm, and of good quality; ripened April 25th. King of the Earlies is a very good variety, especially for home consumption; very prolific, bearing early, and continuing to bear for some time; berry is rather small, nearly round in shape, of bright color, of good flavor and somewhat tart, and ripened April 25th. St. Joseph is a good variety; berries not very large, of good quality, and ripening April 30th. Louise Gauthier grows rank, with large leaves and large berries. One berry measured 4½ inches in circumference lengthwise and 2½ inches in circumference crosswise. The berry is pithy, irregular in shape, and not very highly colored; rather unripe in flavor. It is a late-bearing variety; the first berries ripened May 1st and bore later in the season than any other berry.

J. O. Titlow, Alameda, Alameda County.—All of the ten varieties of strawberries showed great superiority to common market kinds. All have fruited abundantly, berries ripening well, even on the undersides, near the ground, and some of the varieties stood short periods of drought without signs of wilting, while market kinds around them died.

S. Lydard, Cupertino, Santa Clara County.—I planted the Monarch and Royal Sovereign in the spring, on sandy loam with clay subsoil, and had berries during the summer. I am much pleased with both varieties.

Andrew Carpenter, Cupertino, Santa Clara County.—King of the Earlies was quite satisfactory; a fair bearer, with small berries. Monarch is more than satisfactory with me. It commenced to bear large, red, fine-flavored berries in May, and continued until December. The plants were loaded with berries. The Royal Sovereign is fully as good as the Monarch, but the plants continue to bloom and fruit all the time. It has large yellow and pink berries of fine flavor. The Sensation gave a fair-sized crop. The large red berries are of good flavor, but a number were hollow-hearted. All the strawberries were planted on creek bottom land, sandy loam, gravel subsoil, with plenty of stable manure before planting. They had morning sun only.

Miss A. F. Starkey, Daunt, Tulare County.—On February 17, 1900, I received a dozen strawberry plants and set them out shortly afterward. They began to bloom March 3d; were transplanted October 30th, and in 1901 there was an unusual production of berries and runners. The Royal Sovereign and President Carnot are the handsomest plants and heaviest bearers; Louise Gauthier the most delicious berry.

K. E. Conover, Santa Barbara, Santa Barbara County.—The French strawberries proved a failure here, King of the Earlies being the worst and Scarlet Queen the best.

G. B. Mowry, North Pasadena, Los Angeles County.—President Carnot strawberry was a grand success. The plants have had three crops of large, fine berries, and another crop is on at this date (August 31st).

W. Stephenson, Alpine, San Diego County.—On March 3d I planted the ten varieties of European strawberries. The St. Joseph and Commander died, as I neglected to water them. The others did fairly well. On June 27th I gathered fruit from some of them. Sensation, fruit scarlet, sweet; Louise Gauthier, fruit pale, fine flavor; Scarlet Queen, fruit tart.

FIELD AND GARDEN VEGETABLES.

VEGETABLE MARROW.—These squash varieties are not widely known in this State, although highly esteemed by residents of European birth, who understand the best methods of preparation for the table. They have a characteristic flavor quite different from ordinary squashes. In order to get the pleasant flavor, however, it is necessary to gather the fruit while still young and green, before the seeds mature (experience quickly teaches just when). The English method of treatment, which brings out the true marrow flavor, is to cut into longitudinal sections, pare and take out the seeds, drop into boiling salted water and boil until tender; drain and serve, without mashing, with a white sauce dressing. Ripe Vegetable Marrow may be boiled in the shell; when tender scrape from the shell, mash and season as with summer squash. Other culinary methods are also satisfactory, one of which is described by one of our correspondents below:

Henry Crocker, Milford, Lassen County.—King's Acre Cream Vegetable Marrow came up and did well, but did not reach good condition before the frost came.

W. C. Bradford, Arbuckle, Colusa County.—Vegetable Marrow grew well, but the blossoms seem to be all male and no fruit set.

Peter Bonta, Navarro, Mendocino County.—Vegetable Marrow made a very good growth.

H. E. Brown, St. Helena, Napa County.—King's Acre Cream Vegetable Marrow is a good bearer and a good summer vegetable, and I think it will keep well for winter.

E. Eaden Cook, Napa, Napa County.—The Vegetable Marrow is of excellent quality; better in flavor than the ordinary table squashes. Owing to the absence of frost I had young Vegetable Marrows quite late in November. I should not call them very prolific. I grew them in a fertile slough.

A. C. Boyes, Sonoma, Sonoma County.—The Vegetable Marrow (English) has been grown by me for the past ten years, and is a perfect success. Now the Italian market gardener, to whom I gave some seeds to start with three years ago, says people like this English Marrow so well that he can not sell the ordinary summer squashes. It continues to bear until very late in the fall. It makes a delicious white soup, and cut in round slices and fried in egg and cracker crumbs makes a most tasty, nutty dish.

William Crosby, Livermore, Alameda County.—Vegetable Marrow is a summer squash of fair quality; not prolific; not so good as the Turban or the Bush.

Andrew Carpenter, Cupertino, Santa Clara County.—The Vegetable Marrow, planted in the same kind of soil in which strawberries do well, grew very well and were fine eating.

A. B. Burdick, Kaweah, Tulare County.—King's Acre Cream Vegetable Marrow, planted on dark, sandy loam, grew rank; crop heavy; highly flavored.

Charles F. Collins, Dinuba, Tulare County.—The Vegetable Marrow, planted on May 4th in sandy loam, with only ordinary care and cultivation, and but three irrigations during the spring and summer, was ready for the table July 15th, and is a very profitable bearer.

EDIBLE-POD PEA.—This English variety continues to win favor and adds to the popularity shown in our earlier reports. It is a delicious vegetable cooked in the pod, which is entirely stringless. The plant is sturdy and grows about five feet in height, bearing a purple bloom. The pod is about four inches in length, much curled and semi-transparent.

A. F. Etter, Briceland, Humboldt County.—The Edible-Pod Peas can not be spoken of too highly. They are extra fine.

George Anderson, Hilton, Sonoma County.—Edible-Pod Pea yielded very well.

E. L. Anderson, Hilton, Sonoma County.—The Edible-Pod Peas are excellent.

J. O. Titlow, Alameda, Alameda County.—Edible-Pod Pea plants grew tall, but the crop was small, and molded even in a warm airy place, but near a broad fence.

Mrs. L. A. Walker, Berkeley, Alameda County.—The Edible-Pod Peas grew thriftily, bore profusely, and were pronounced delicious by all who ate of them. The bed in which they grew is now (December) full of thrifty young plants self-sown. The recent hard frosts do not seem to have touched them.

C. A. Braun, Cupertino, Santa Clara County.—The Edible-Pod Pea I found to be both prolific and delicious.

Grant Wallace, Pomelo, Sacramento County.—The Edible-Pod Pea is apparently a failure here, even with irrigation.

ASPARAGUS PEA (*Tetragonolobus purpureus*).—This plant was distributed from this Station under the name "Square Pod Pea" as a green-manure plant. Its winter growth was not satisfactory. Later the esculent character of the growth became apparent, and later distributions have been upon that basis. Much satisfaction has resulted, as the following notes show:

Peter Bonta, Navarro, Mendocino County.—Asparagus Pea is a good vegetable. We have a twenty-foot row from which we have a good mess once a week, and they are still blossoming in the autumn.

Leslie Hoag, Boonville, Mendocino County.—Asparagus Pea grew, and is very ornamental.

George Anderson, Hilton, Sonoma County.—The Asparagus Peas grew well and yielded well, but are not of much value for culinary purposes.

J. O. Titlow, Alameda, Alameda County.—Asparagus Peas grew poorly until irrigated. When two inches high they blossomed and afterward grew six inches, with large crop of large peas too fibrous to eat; small ones became fibrous later in the season, but plants produced until very late, with irrigation. The plant is only good as a curiosity, as peas are uneatable unless so small that they are a nuisance to gather. [This experience shows lack of appreciation of the fact that the peas and pods are to be cut and cooked like string beans.—W.]

A. J. Palmer, Livermore, Alameda County.—The Asparagus Peas, planted on soil in which there is some gravel, yielded profusely during the season, and many young plants are up. The frost has not affected them, although the old plants are dead. We think these peas would make a beautiful border plant for gardens, as the leaves and flowers are so rich in color.

Thomas Casalegno, Evergreen, Santa Clara County.—The Asparagus Pea will grow in very very dry ground without water and bear well. It is a very good vegetable.

Thomas W. Cowan, Pacific Grove, Monterey County.—Asparagus Pea grew and flowered well, but became infested by a fungous disease, the pod being covered with brown spots.

William M. Dail, Jamul, San Diego County.—Asparagus Peas proved very satisfactory.

OTHER GARDEN PEAS.—From various sources supplies of new varieties were secured for local trial by our correspondents. The following notes are descriptive of them:

Mrs. Wenonah Stevens Abbott, Oak, Shasta County.—Barstow Sugar Pea well deserves its name. Daisy Carter bore profusely. Burpee's Profusion did all that we could expect, but I would not recommend it for use while green. Possibly it would be better for winter use.

A. B. Kausen, Ferndale, Humboldt County.—Laxton's Evolution Pea did fairly well. It was quite early, but not so early as some we have here. The vines were not very long. The Quality, Nott's Excelsior, and Daisy Carter Peas all did well, being quite late, with long and bushy vines and full of large pods. I feel satisfied that they will make fine cow feed.

T. Bonta, Elk, Mendocino County.—Barstow's Sugar Pea did well and is excellent.

R. P. Brandt, Fishrock, Mendocino County.—Nott's Excelsior is equal to and seems identical with American Wonder, and does well here.

Robert Hastie, Clayton, Contra Costa County.—Daisy Carter Pea is splendid. Russian Pea grew five feet high, bloomed and dried up.

William Schmidt, Blanco, Monterey County.—The Alderman Pea was planted on light, adobe soil, on March 5, 1901, and did well.

John Dooner, Linden, San Joaquin County.—William Hurst and Boston Unrivaled Peas are most prolific, although I prefer the Excelsior, it being dwarfed. None of these had a fair chance, as the spring rains were far between, and I was not prepared to irrigate them until too late to expect good results. Under these adverse conditions they far exceeded my expectations.

Charles F. Collins, Dinuba, Tulare County.—Nott's Excelsior, Boston Unrivaled, and Alderman Peas, planted February 28th, were ready for table on May 1st, May 15th, and May 20th, respectively. All bore heavily.

E. Hoffner, Orange Vale, Sacramento County.—Ceylon Peas prove abundant bearers with large pods full of rich peas. They are very good for cooking until almost ripe. I will plant this year so as to secure a succession of them for six weeks or more.

W. Croll, Quicksilver, Lake County.—I have raised the Chick Pea (*Cicer arietinum*) for the past seven years, and find it much better than the common dried pea; and it is never troubled by weavils. The pea does best if planted in March or April.

John Jacob Schmidt, Bissell, Clackamas County, Or.—Nott's Excelsior Pea was very early, very productive, and altogether a most satisfactory pea.

VARIOUS BEANS.—Of bean varieties from various sources quite a large distribution has been made of late, and several new to the State are proving valuable and likely to remain in garden culture. The following are worthy of note as pointers for other growers who desire to vary their plantings:

H. Crocker, Milford, Lassen County.—Burpee's Stringless Bush Beans are excellent for table use.

Mrs. Wenonah Stevens Abbott, Oak, Shasta County.—Windsor Beans nearly all germinated. Heavy rains during blooming period probably lessened the amount of bearing, but those which we tried proved very good.

George B. Pearce, Paradise, Butte County.—Veitch's Climbing French Bean did very well and yielded a nice lot of beans and did not need any poles. On the whole, they were not as good snap beans as some other kinds we have grown.

Louis Hardt, Grass Valley, Nevada County.—French Climbing Bean did first rate; planted the latter part of May.

A. B. Kausen, Ferndale, Humboldt County.—European Broad or Windsor Bean did very well, although it is no new bean here.

Albert F. Etter, Briceland, Humboldt County.—Burpee's New Stringless Bush Beans did very well and were of fair quality. Scarlet Russian Bean grows well and is a good eating bean shelled green. Windsor Bean is still growing, but has so far failed to bear.

A. B. Kausen, Ferndale, Humboldt County.—Burpee's New Stringless Bush Bean did not have over three beans to a pod and many pods had none in them, but they were stringless.

Peter Bonta, Navarro, Mendocino County.—Broad Windsor Bean is a splendid eating bean.

Robert Hastie, Clayton, Contra Costa County.—Burpee's Stringless Bush Bean and Windsor Bean have done well.

O. B. Dobson, Lodi, San Joaquin County.—Burpee's New Stringless Bush Bean was a great success. It bore the entire season and the beans were first class.

H. H. Huttenberger, Oakland, Alameda County.—Burpee's New Stringless Bush Bean is the best bush bean we ever had. We have given quite a quantity of seed to friends.

J. O. Titlow, Alameda, Alameda County.—Veitch's Bean makes long, well-filled pods, but is some weeks later than the market varieties of bean. It made an excellent growth in a warm spot with moderate irrigation. Heavy crop of beans immeasurably superior to common bean.

W. L. Sales, Petaluma, Sonoma County.—Burpee's New Stringless Bush Bean, planted on sandy soil well fertilized with chicken manure, where it received the coast breeze, as well as fog, has proven a profuse bearer. The pods are large and well filled, and the beans cooked tender (when used green) in about one hour.

William Crosby, Livermore, Alameda County.—Broad or Windsor Bean (commonly called "Portugee Bean") is an excellent vegetable in all varieties; as hardy as the pea; with plenty of water and only moderate frost it will bear throughout the year. The young pods are edible as "snaps." Dwarf Fan or Cluster blossomed very freely; seed set moderately; quality fair. Perfection is a heavy bearer; quality good.

C. P. Fairfield, Campbell, Santa Clara County.—The white center Scarlet Runner Bean was planted middle of February to shade a south porch, which was soon covered, and the beans lasted until the last of October.

William Schmidt, Blanco, Monterey County.—Green Giant and Giant Windsor Beans planted on light adobe soil did not do well.

C. W. Leffingwell, Jr., Whittier, Los Angeles County.—Burpee's New Stringless Bush Beans grew splendidly and bore very heavily; the beans were among the finest we ever had, being quite stringless.

F. Ferguson, Santa Ana, Orange County.—The European Windsor Bean did well, but when nearly ripe the pods got black and seemed to rot.

Herbert Veall, Dulzura, San Diego County.—The Windsor Bean grew for awhile and looked fine, but then turned black and died. An English acquaintance of mine said I would not be able to raise this bean, as they had tried it again and again and it would never mature.

SOY BEAN (*Glycine hispida*).—This Asiatic species, which was formerly called "soja bean," seems on further trial to be winning wider favor in California. Earlier trials on the plains seemed to show that the repeated drought-resistance of the plant was not adequate to meet the most trying summer conditions in California; but recently better reports arising from trial on moister lands are available. The following shows the trend in this direction:

Leslie Hoag, Boonville, Mendocino County.—The Soy Bean grew very slowly, but is of good quality, and is a splendid cow feed late in the season.

Grant Wallace, Pomelo, Sacramento County.—The Soy Bean is very prolific. Grown without irrigation it produced largely, sown broadcast.

J. B. Swan, Hollister, San Benito County.—The Soy Bean made a large growth of top, but failed to bear any beans. I think it would be a valuable forage plant. Cows are very fond of it.

KALE.—We have introduced various kales, both for kitchen use and for stock feeding. Of the former, "Condorrat Green Curly Kale" and "Welsh Kale," from Dobbie & Sons, of Rothsay, Scotland, have proved very good. The Jersey Kale, which has been amply characterized in our early reports, is more widely grown each year in all parts of the State, chiefly for poultry feeding. The following reports cover both classes of kale:

R. Hastie, Clayton, Contra Costa County.—Curly Kale did well as long as the moisture lasted, then dried up.

F. G. Wulzen, Haywards, Alameda County.—Have raised about fifteen heads of Jersey Kale from seed. It has supplied me with remarkable amount of green feed for both cows and horses.

H. Hundertmark, Sacramento, Sacramento County.—The Kale seed of several varieties yielded fine plants, some reaching four feet in height. Coming as we do from Schleswigholstein we esteem Kale highly as a table vegetable; we also find it the best green feed we can get for chickens. They like it even better than alfalfa, and I believe much of our success this year with poultry is due to the Kale, which is the best green feed we can get for chickens in the winter.

Andrew Carpenter, Cupertino, Santa Clara County.—The tall Green Kale planted in the spring did not mature until in the winter, as I was not able to irrigate it. From December 1st to January 18th I have had as fine Kale as could be asked for. It grew over three feet tall, and was very fine eating.

Frank Concklin, Los Gatos, Santa Clara County.—Tall Green Kale was especially good, crisp, and a large yielder. It is the best feed I know for chickens.

John J. Booth, Haywards, Alameda County.—Jersey Kale is a vigorous grower, stands heat well, and is relished by poultry.

W. Croll, Quicksilver, Lake County.—All the Kales did well.

A. B. Kausen, Ferndale, Humboldt County.—Sutton's A-1 Curly Kale did well.

JERUSALEM ARTICHOKES (*Helianthus tuberosus*).—This esculent root has been quite fully discussed in our earlier reports. It seems to be gaining in popularity for table use and to thrive better when given fair garden treatment. Its standing as stock feed seems to be rendered questionable by the fact that those who begin by loudly praising it, in many cases allow it to lapse into disuse. The tubers keep well in the ground, to be dug as required for use. They do not keep well when taken up and stored, unless it be in damp sand in a cool place. The following are the latest reports from growers:

P. Bonta, Navarro, Mendocino County.—Jerusalem Artichokes deserve attention, as they yield splendidly; but after there is plenty of grass I can not get the hogs to eat them, and I feed them to the cows, which seem to like them.

J. O. Titlow, Alameda, Alameda County.—Jerusalem Artichokes have grown remarkably well in very dry soil.

Samuel Lord, Penryn, Placer County.—The Jerusalem Artichokes attained a fair size and made a good crop.

A. W. Wedderburn, Pomona, Los Angeles County.—The Jerusalem Artichokes planted last March have grown finely; we have been using them for table since first of October, besides giving some away. We will have enough to last through winter months if they will keep.

RED ETAMPES PUMPKIN.—This variety was imported from France; seed kept pure, and were tested for four years at one of the University substations. It is a large and showy variety; new to California. Very fine for cooking, and a good bearer for stock purposes.

Henry Crocker, Milford, Lassen County.—The Red Etampes Pumpkin is a fine one, but the plants do not bear heavily here, and the largest pumpkin weighed eleven pounds.

John Dixon, Santa Rosa, Sonoma County.—The Red Etampes Pumpkin produces very large fruit of a quality surpassing anything I have ever used for the table, while at the same time yielding as much as ordinary stock varieties. It is a good keeper.

Grant Wallace, Pomelo, Sacramento County.—Red Etampes Pumpkin did well, with slight irrigation. It is large and of good quality; superior to any I have tried here.

J. B. Swan, Hollister, San Benito County.—The Red Etampes Pumpkins are excellent.

A. B Burdick, Kaweah, Tulare County.—Red Etampes Pumpkin planted on clay loam did not grow very rank, but the pumpkins are of fine quality.

KANSAS STANDARD TOMATO.—This variety, received from Barteldes & Co., of Lawrence, Kansas, has demonstrated its value in this State. It made a strong, healthy growth in the Experiment Station garden at Berkeley; and its adaptability to the Bay region climate seems to be demonstrated by the fact that it was the first variety to ripen seed with us for some years. It is somewhat dwarf in habit and is perhaps slightly deficient in flavor, but it is a remarkably prolific fruit-producer. The following reports show that it is hardy and productive in both coast and valley locations:

Peter Bonta, Navarro, Mendocino County.—Kansas Standard Tomato was the only tomato that ripened here on the coast. It is very stocky and does not grow bushy, thus admitting plenty of sunshine to the fruit.

W. F. Waterman, Berrios, San Luis Obispo County.—The Kansas Standard Tomato, planted late on rich, moist bottom land, made a good growth, and I think it is a success as to quality.

Charles F. Collins, Dinuba, Tulare County.—Kansas Standard Tomato bore heavily; fruit was of fine quality.

S. J. Bunting, Bloomington, San Bernardino County.—The Kansas Standard Tomatoes were fine.

John Jacob Schmidt, Bissell, Clackamas County, Oregon.—Kansas Standard Tomato was sown in the middle of March in a cold frame bed, but did not germinate until May. During the cold weather in June the plants were very small and feeble, but in July they grew very strong and vigorous and bloomed the last of July. This variety dropped a few blossoms, but plenty of fruit set and the first ripe fruit was picked on the first of October. It was all of fine color and large size.

NEW SHORT WHITE CARROT.—This very thrifty variety has been highly approved by our correspondents, and will take permanent place in California gardens. The following are supplementary to conclusions published in our earlier reports:

George B. Pearce, Paradise, Butte County.—The New Short White Carrot was the finest carrot we have ever grown. It was sweet and nice for the table, and stock are very fond of it. It also grows to a large size and is easily pulled.

Leslie Hoag, Boonville, Mendocino County.—The New Short White Carrot is extra good both as to quality and growth.

Mrs. L. A. Walker, Berkeley, Alameda County.—The New Short White Carrot is the most delicious-flavored and fine-grained vegetable I have ever tasted.

J. O. Titlow, Alameda, Alameda County.—The New Short White Carrot made a large crop, but size was small on account of its being too dry; seems to need much moisture.

SWEET CORN VARIETIES.—It is difficult to secure a variety of sweet corn really superior to the older standard sorts for California conditions. Most of our introductions have proved disappointing, as earlier reports have shown. The following are hardly more favorable, though some growers have found characters acceptable to them:

Henry Crocker, Milford, Lassen County.—Washington Market Corn came up well and stooled, but did not mature.

A. B. Kausen, Ferndale, Humboldt County.—Burpee's Earliest Sheffield Sweet Corn grew tall, but was otherwise a failure.

S. S. Ward, Napa, Napa County.—Washington Market Corn made very tall stalks and large ears of good quality. The variety does not seem to be any later than the Mammoth or Evergreen.

A. C. Hull, Santa Rosa, Sonoma County.—Burpee's Earliest Sheffield Sweet Corn was prolific, but not very early.

W. L. Sales, Petaluma, Sonoma County.—Burpee's Earliest Sheffield Sweet Corn, planted on sandy, well-fertilized soil, but not irrigated, was quite satisfactory. It matured two weeks earlier than any other sweet corn I planted. The corn received the coast breeze as well as fog.

J. O. Titlow, Alameda, Alameda County.—Washington Market Corn grew slowly until midsummer, when it was irrigated and then grew to twelve feet tall with late, heavy crop of large ears, which are not sweet enough for market. The second year it grew sweeter, but its only value, compared with sweet corn, is in its appearance.

William Crosby, Livermore, Alameda County.—Burpee's Earliest Sheffield Sweet Corn is medium early, of fair quality, and a moderate bearer, but has no special merit.

Frank Concklin, Los Gatos, Santa Clara County.—Mammoth Sugar Corn is much better than Stowell's Evergreen both in quality and in quantity.

Andrew Carpenter, Cupertino, Santa Clara County.—Burpee's Earliest Sheffield Sweet Corn grew, but failed to produce ears of corn.

G. D. Guilford, Creston, San Luis Obispo County.—Burpee's Earliest Sheffield Sweet Corn yielded about a fourth of a crop. I have seed for next season, and think it a good corn.

F. Ferguson, Santa Ana, Orange County.—Burpee's Earliest Sheffield Sweet Corn was planted late, but did well. I have obtained a fine lot of seed.

FIELD AND GARDEN MELONS.

HONCHARENKO WATERMELON.—This proved to be the best of some sixty varieties tested at the Paso Robles substation. It is of particularly good appearance, round, small in size, small seeded, very drought-resistant, and in quality superior to the "Hungarian Honey" Watermelon. Raised from seed sown at Ukraina, Alameda County, in the hills near Haywards, and donated to the Station by Father Agapino Honcharenko. The following are conclusions of our correspondents:

T. E. Rice, Livermore, Alameda County.—Honcharenko Watermelon vines grew quite well, but dried out about the middle of July without any melons.

Andrew Carpenter, Cupertino, Santa Clara County.—The Honcharenko Watermelon seed grew well, but the melons were only about three or four inches in diameter and very sweet.

Hal. G. Osborn, Los Gatos, Santa Clara County.—The Honcharenko Watermelon we liked very much. It is a sweet and firm melon, but very small.

Charles F. Collins, Dinuba, Tulare County.—Honcharenko Watermelon, planted May 4th, was ripe July 25th, and bore very heavily, but I did not like the flavor very well.

G. H. Cuplin, Nordhoff, Ventura County.—The Honcharenko Watermelon was a success. The first crop was all picked on September 17th. The vines then commenced to blossom and set a new crop, which is larger, but the melons do not seem to grow so large. The first crop grew to ten inches in diameter; was the shape of the citron, and of about the same color, with a large number of seeds and good solid meat, ripe close to the rind.

John Jacob Schmidt, Bissell, Clackamas County, Oregon.—The Honcharenko Watermelon seed germinated well, but the young plants perished during the cold, rainy weather in June.

TURKESTAN WINTER MUSKMELONS.—The production of winter muskmelons is largely increasing in California, as the local climate is splendidly suited to these late-ripening and long-keeping sorts. A number of varieties secured in Russian Turkestan by an agent of the Department of Agriculture were grown at the substation near Pomona. Planted late in May they made their growth in a very dry year without irrigation and all the varieties proved four times as prolific as the common garden varieties of muskmelon planted under similar conditions. All are melons from the native home of the finest known varieties, in the famous oases along the historic Oxus, the ancient Chorasmia and Sogdiana. The following are the conclusions of our correspondents as to their growth and value:

Henry Crocker, Milford, Lassen County.—From the Persian Melon seeds we secured one melon, 7 x 11 inches, with a very fine grain and excellent flavor.

George B. Pearce, Paradise, Butte County.—The Persian Melons have been fairly successful and some of them kept until Christmas time. They appear to be of rather poor flavor but firm. They are similar to the Winter Pineapple melon. We tried them for making preserves, and found them delicious.

Leslie Hoag, Boonville, Mendocino County.—The Persian Melons Nos. 121 and 122 were fine and kept until November.

Felix Gillet, Nevada City, Nevada County.—The Persian Muskmelon has done very well, but its principal merit is its long-keeping qualities.

J. C. Hamaker, Newcastle, Placer County.—I do not consider the Persian Melons of much value, as they ripen too late here and are rather flat in flavor.

Grant Wallace, Pomelo, Sacramento County.—Persian Melons withstood the drought far better than cantaloupes, but not nearly so well as watermelons. They were irrigated a few times. Two kinds, Nos. 115 and 123, were especially prolific, although many of the melons were small and immature. No. 114 was of excellent flavor—very thin flesh. Nos. 115 and 123 were not so good.

E. H. Crane, San Lorenzo, Alameda County.—Persian Melon vines are vigorous growers and produce melons in abundance. The meat is thick, without particularly good flavor.

William N. Russell, Los Gatos, Santa Clara County.—Persian Melon seed, No. 115, from Old Amu Darya, were planted in two hills, one of which sprouted and bore seven melons; vines thrifty. No. 117, from Old Amu Darya, planted in one hill, bore two small melons; vines not thrifty. No. 122, from Old Amu Darya, were planted in three hills, two of which sprouted and bore five melons; vines thrifty. These melons are of fine flavor and kept about three weeks after being gathered.

J. B. Swan, Hollister, San Benito County.—The Persian Melon seed were planted very early and we are very pleased with them.

Charles F. Collins, Dinuba, Tulare County.—Khiva Winter Muskmelons were planted May 4th. Bugs killed all but one plant, which was severely injured by stock later in the summer, but not before it had produced two large melons, which were picked October 1st and laid under the house to ripen. They were cut and eaten November 20th; of delicious flavor, thick meat, and very firm.

Khama Melon.—This curious little stock-melon came from the Kalahari desert in South Africa, and in its native country is said to grow well on exceedingly arid soil. At Pomona substation, without water, on sandy soil, it yielded at the rate of twenty-two tons to the acre, and cows and horses ate them readily. California reports are various. In Southern California the plant had to strive with exceptional drought, and probably won less favor than it would have received in the same districts in seasons of normal rainfall. The test was a severe one:

W. A. Butler, Cottonwood, Shasta County.—The Khama Melon proved itself worthy of further trial.

F. A. Wilkendorf, Woodland, Yolo County.—The Khama Melon seeds did well; not requiring so much moisture near the surface, as the tap-root goes down to a considerable depth.

Isadore Lecureuil, Santa Cruz, Santa Cruz County.—The Khama Melon is exceedingly prolific, a single plant having produced this year no less than forty-five melons, none larger than six inches in diameter. In weight it surpassed any production of squashes or pumpkins in the same space of ground.

C. W. Leffingwell, Jr., Whittier, Los Angeles County.—The Khama Melon seeds were planted on rather heavy loam which had been irrigated once. Only one plant came up, which spread over a good deal of space and bore about a dozen small melons. The hot spells which we had in the summer dried the vine up so that it looked nearly dead, but it revived immediately when damper weather came, and continued to grow and blossom and set fruit. I have saved seed enough to plant quite a patch to this melon next year.

A. C. Athern, Alpine, San Diego County.—The Khama Melon plants yielded fifty-two melons from the size of an orange to five inches in diameter.

H. H. Gird, Bonsall, San Diego County.—The Kahma Melon yields heavily, but I think it will hardly displace the cow melon for stock-feeding.

CEREALS.

A number of varieties of various grains received from the Seed and Plant Introduction division of the Bureau of Plant Industry of the U. S. Department of Agriculture have entered largely into our recent distributions. It is too soon to receive wide account of their local behavior. This will come later, but the following notes are given at once as suggestive to those who are experimenting along cereal lines:

T. E. Rice, Livermore, Alameda County.—Early Genessee Giant Wheat did not prove to be very early nor very much of a giant. By the first of June the straw was two inches long with heads one inch long just beginning to fill, while Sonora Wheat beside it sown the same day was over four feet high and fully ripe. We had a few light showers about that time and the Genessee took a fresh start and grew about a foot higher, but the heads, which were of the club variety, did not increase in size. It finally ripened in July, about six weeks after Sonora. This wheat might do well near the Bay, but it is not adapted to this climate.

Canadian Hybrid Wheat unfortunately turned out to be nearly all smut. I cut part of it for hay and it made the best colored hay that I ever handled. I think it will be a valuable variety for hay, as it makes a very heavy crop and holds its bright green color so well, even when the grain is nearly ripe.

A. C. Hull, Santa Rosa, Sonoma County.—Hungarian Wheat sown in January in well-prepared beds nearly all rotted, and that which did come up was destroyed by the Hessian fly.

J. R. Scribner, Palermo, Butte County.—I sowed ten pounds of Early Barrt Wheat on high, plain land at the early plowing. It ripened as early as barley and two weeks earlier than any wheat in the country. When threshed it yielded 140 pounds.

Theodore C. Asmus, San Miguel, San Luis Obispo County.—I find Early Barrt and Early King Wheats to be adapted to this climate. Early Barrt gave a return of 45 pounds and Early King 39 pounds. Both varieties are earlier than the Propo Wheat and fully as early as the Sonora.

W. Stephenson, Alpine, San Diego County.—Although late I planted four packages of Hungarian Wheat on March 3, 1900, in drills about 3½ feet apart and cultivated. It did not mature grain, although it stooled well. It is making quite a showing now (January), coming up from old roots.

F. H. Preston, San Luis Obispo, San Luis Obispo County.—Mawe and Hedeba Algerian Wheat made very good growth, but the straw was a little inclined to rust and the grain to smut. One row of our native wheat was planted at the same time and in the same plat as a test of the others. Hackett's was in the lead of them all. It had larger heads and was ten days earlier. It had neither rust nor smut. I consider it a very valuable sort here on the coast. Hackett's Australian Wheat was planted January 20th. It made very rank growth. The straw was bright and stiff and supported the heads of grain well.

J. J. Bamber, Skyland, Santa Cruz County.—The Algerian Wheat did very well, but being a bearded kind is not good for hay.

H. Crocker, Milford, Lassen County.—Golden Giant Side Oats, planted March 12th, grew from fifteen to eighteen inches, but most of it ran to smut.

F. A. Wilkendorf, Woodland, Yolo County.—The Shatilov and Danish Island Oats were planted in the spring, and made a good start; later on, the dry winds parched the plants, but I think, with earlier sowing, either kind of oats would be adapted to this region.

William M. Dail, Jamul, San Diego County.—The Shatilov Oats sown the first part of January made little growth, owing to dry weather, until the rain of March 4th pushed it ahead and we gathered a fair crop in July. There was no rust whatever on the oats, which speaks well for it.

August Hagemann, Livermore, Alameda County.—From five pounds of Moravian Barley, sown on the 12th of March, 1901, in orchard in drills one foot apart, I raised 300 pounds, but the seed was very much shrunken, probably due to late sowing. It ripened fully ten days sooner than any other variety of Chevalier sown ten days earlier close by in same kind of soil.

George Taylor, Florin, Sacramento County.—I grew two varieties of hullless barley for twenty years in Canada and Manitoba. I brought one handful to this country fifteen years ago, but I have had little success with it. I have sown 120 pounds this year. It makes the best meal for hogs of any grain I ever saw. It is granular and not pasty.

F. H. Preston, San Luis Obispo, San Luis Obispo County.—Nepaul Barley, planted January 20th, grew well. I think it a valuable variety for hay and grain. I am well pleased with its appearance.

J. W. Armstrong, Garden Valley, El Dorado County.—Winter Ivanof Rye grew three feet high and matured good grain.

W. A. Butler, Cottonwood, Shasta County.—Winter Ivanof Rye was planted in drills last fall, just after the first rain, on ground in which beets had been grown the summer before. It came up with very slim, spindling leaves, and when four or five inches high it disappeared all at once. The birds may have pulled it up.

W. A. Butler, Cottonwood, Shasta County.—Red Russian Millet came up with a short, stubbly leaf about one quarter inch wide and one half inch long, and did not seem to grow any more. It disappeared suddenly.

Frank Concklin, Los Gatos, Santa Clara County.—Red Russian Millet grew well, but seed was rather uneven in ripening, especially from the lower branches.

J. H. Wittpenn, Indio, Riverside County.—Red Voronezh Millet, sown March 1st, grew well and was cut April 27th, rather too early to make a full seed crop, but early cutting was necessary because of the depredations of birds. Crop was grown with irrigation, as our rainfall is too light for crop purposes.

A. C. Hull, Santa Rosa, Sonoma County.—Black Voronezh was sown April 16th in drills eighteen inches apart; ripened middle of June and grew very rank; yielded well, but shattered very badly. Planted second crop last of September; did not shatter; grain very plump. Third crop ripening now. Stands frost about the same as corn. Seed very rich; fine hen feed, if not fed too heavily.

J. W. Armstrong, Garden Valley, El Dorado County.—Tambov and Black Voronezh Millets grew about sixteen inches high and matured a quantity of seed.

PREHISTORIC CORN.—Experts say there is nothing "prehistoric" about it, but it is a very hardy and strong-growing cross-bred variety. Very tall and prolific of ears, which are dark red, kernels long and hard; a flint variety.

Leslie Hoag, Boonville, Mendocino County.—Prehistoric Corn is good for green feed or silo, but the amount of grain is small and it would probably do better in a warmer climate.

P. Bonta, Navarro, Mendocino County.—Prehistoric Corn was planted by the side of common small yellow, and I noticed very little difference in the growth of the two kinds.

John Dixon, Brook Hill, Santa Rosa, Sonoma County.—Prehistoric Corn has proved to be an uncommonly strong grower and yielding in many cases five ears to the stalk, but is rather late in maturing.

Sandberg Brothers, Neenach, Los Angeles County.—Prehistoric Corn was planted in the center of an acre field of Bloody Butcher Corn, but the latter made much better growth and seems to be preferred on dry land.

HARDY LEGUMES FOR FORAGE AND GREEN-MANURING.

FIELD PEAS FROM RUSSIA.—A variety recently introduced from Russia by the U. S. Department of Agriculture has been tried in California both for winter growth for green-manure and summer growth for forage. It is represented as particularly hardy.

A. Hain, Ager, Siskiyou County.—Russian Field Peas came up at the time that wheat usually comes up; they stood the frost well, but in the spring they made a slow growth. The Hairy Vetch came up in the spring, and also made slow growth. Neither the field peas nor the vetch had any tubercles on the roots.

George B. Pearce, Jr., Paradise, Butte County.—The Russian Field Peas grew finely and made a large amount of forage on rather poor soil. They were irrigated occasionally as they needed it, as I found they would die before maturity if not irrigated. We had no frosts to try their hardiness.

J. W. Armstrong, Garden Valley, El Dorado County.—Russian Field Peas grew about two feet high and are a good variety of peas.

E. F. Etter, Briceland, Humboldt County.—The Russian Field Pea is not only the latest of many varieties, but I was surprised to find it to be one of the very best table peas of all. It grows so rank that it would be a great hay pea to grow for stock.

T. Bonta, Elk, Mendocino County.—Russian Field Peas did fairly well.

R. P. Brandt, Fishrock, Mendocino County.—The Russian Field Peas make a rapid growth, some vines attaining a height of four or five feet; but they are such shy bearers that it is hard to get a supply of seed.

F. Segsworth, Ben Lomond, Santa Cruz County.—The Russian Field Pea does well here on our hill land. I had some this season that made a growth of seven feet and were in bloom continually for six weeks. Sown with oats they make a fine forage crop, but do not make as heavy a growth early in the spring as the vetch, so would not be so good for green-manuring.

C. W. Leffingwell, Whittier, Los Angeles County.—The Russian Field Pea planted at the same time and in the same soil as that in which the Bitter Vetch was planted grew about sixteen inches high and seemed to resist drought fairly well. It made enough growth to furnish a fair amount of fodder, but did not blossom before it turned yellow and dried up.

W. Stephenson, Alpine, San Diego County.—The Russian Field Peas, although cultivated, were a failure, as the weather was very dry, and I did not irrigate them.

HAIRY VETCH (*Vicia villosa*).—This plant bids fair to serve a double purpose in California. It makes a fine winter growth (except on heavy soil which is likely to be excessively wet in winter), and is therefore available for covering-in early in the spring for green-manure. It is also exceptionally resistant of drought and in many places will grow during the dry season without irrigation. Both as green forage and as hay it is very acceptable to stock, and if sown with oats or barley will rise from the ground so as to be readily handled with the mower. Reports thus far received are very favorable.

George B. Pearce, Jr., Paradise, Butte County.—I sowed the seed of the Hairy Vetch on light, red, upland soil. It germinated freely, but made little growth during the summer, except a little plot about ten feet square, on better land than the rest. Some died out entirely. I then irrigated as for alfalfa, and the plants are now (late autumn) growing nicely.

E. F. Etter, Briceland, Humboldt County.—Hairy Vetch sown on March 15th did very well, growing three feet tall. It yielded a good crop of seed, which I sowed in September. It looks well now (January), and I think it is likely to be of considerable value in this locality.

J. W. Armstrong, Garden Valley, El Dorado County.—Hairy Vetch grew about two feet high and made good hay. It is well adapted to this locality.

Charles W. Bingham, Lakeport, Lake County.—The Hairy Vetch grew about twenty inches or two feet on good, loamy hill soil without irrigation, and kept green late in the summer and produced a good deal of seed. As the seed continued ripening during a month or more and did not come to maturity all at once, and the first pods to ripen immediately opened and shed the seeds to the ground, I made no effort to save the seed, but they started up volunteer with the fall rains and the plants are now (November) three or four inches high and quite thick.

R. P. Brandt, Fishrock, Mendocino County.—The Hairy Vetch will not make a good growth on our dry hillsides, but if irrigated in the summer it will show a total growth of twelve feet by the end of the winter following the spring it was sown.

P. Bonta, Navarro, Mendocino County.—Hairy Vetch planted three feet apart in rows on good hillside land made a fair growth in the summer. Some on rocky soil made a start only, but remained green all summer and when the rainy season came they covered the ground in about six weeks. It is a valuable plant for winter growth either for forage or for green-manuring.

T. E. Rice, Livermore, Alameda County.—The Hairy Vetch planted in rich garden soil made a growth of about thirty inches, but did not show any disposition to stand up after it was six inches high. It could not stand the heat after the first of June. There were a great many seed pods, but only a few which grew in the shade of a fence had any seeds in them. Horses and cattle are fond of it, even after it is all burnt in the sun.

C. Nisson, Petaluma, Sonoma County.—The Hairy Vetch did very well, and will, I think, prove profitable in Two Rock Valley, if it does as well when sown in the fall as it did with me sown in the spring.

Mrs. E. Shaw, Sebastopol, Sonoma County.—Hairy Vetch only made small growth in ordinary soil.

R. H. Barkway, Rio Vista, Solano County.—The Sand Vetch started well, but did not make good growth; on account of the spring being dry, the ground baked.

W. F. Pearce, Brentwood, Contra Costa County.—Hairy Vetch has been a great success and made a large crop.

Robert Hastie, Clayton, Contra Costa County.—The Hairy Vetch bloomed, and then dried up for want of moisture.

L. L. Guss, Oakley, Contra Costa County.—Hairy Vetch should be a success for plowing-under in orchards, as when sown in sandy soil in drills four feet apart, it had but one foot of space between rows by April 1st. If sown broadcast in the fall it should be ready to plow-under by February 1st.

I. L. Sanders, Redwood Retreat, Gilroy, Santa Clara County.—Hairy Vetch grew well and we are much pleased with it.

C. C. Wulff, Watsonville, Santa Cruz County.—Hairy Vetch seed sown March 20th made a good growth, although the season was dry. The ground was covered with a thick foliage. I have bought 100 pounds of seed, and am making a trial for winter growth in the orchard for green-manuring.

William Schmidt, Blanco, Monterey County.—Hairy Vetch planted on light adobe soil did well.

W. F. Waterman, Berrios, San Luis Obispo County.—Hairy Vetch on sandy mesa made a good growth and is relished by stock.

W. A. Smith, Lebec, Kern County.—I have tried to grow the Hairy Vetch, but it is of no value.

THE BITTER VETCH (*Lathyrus sativus*).—This hardy legume was recently distributed to determine its relative suitability to California conditions. The following preliminary notes have been received:

George B. Pearce, Jr., Paradise, Butte County.—Bitter Vetch seed germinated freely on rather poor soil with occasional irrigation, and grew about six or eight inches high, quite bushy little plants. They produced a large quantity of seed.

T. Bonta, Elk, Mendocino County.—Bitter Vetch did well, but not so well as Hairy Vetch.

Albert F. Etter, Briceland, Humboldt County.—Bitter Vetch made a fair growth.

Charles W. Bingham, Lakeport, Lake County.—Bitter Vetch grew a little stronger and with larger leaves than Hairy Vetch.

J. W. Armstrong, Garden Valley, El Dorado County.—Bitter Vetch grew to be a fine plant with thirty-five stalks, eighteen inches high, from one seed. It will grow on land too poor to raise peas, and it stands drought well.

C. W. Leffingwell, Jr., Whittier, Los Angeles County.—Bitter Vetch was planted about June in soil that had been irrigated once. It grew without irrigation about six inches high and bore a crop of seeds.

VARIOUS LUPINS.—Trial of lupins for green-manuring has continued for several years, and the earlier publications of the Station are replete with information concerning the several species. The following notes describe the results secured by those who more recently received seed from this Station:

T. D. Morrin, Rumsey, Yolo County.—European White Lupin, planted in drills, on sandy loam in orchard on October 18th, came through the ground October 28th; grew to only about eight inches in height when fully matured. The cold winter seemed against it.

Paul Le Boyd, Elk Grove, Sacramento County.—None of the lupins sent me equals burr clover and the native small blue-flowered lupin as green-manure plants for this section.

L. L. Guss, Oakley, Contra Costa County.—European White Lupin, planted among the trees the 20th of January, made a growth of six inches when plowed-under April 1st.

Charles W. Bingham, Lakeport, Lake County.—European Blue Lupin, planted February 17th on a red gravelly loam foothill soil, made but a poor growth and matured very few seed. I think it of very little value compared with several of the native varieties here, although the growth might be very different if it were planted in the fall to start with the first rain.

William O. Edmands, Upper Lake, Lake County.—European Blue Lupin seed were planted on October 28th in two lots; one lot in my garden and the other in cold, red soil with northern exposure. Those in the garden were up on November 5th and the other lot two days later. The seed seems to possess great vitality, and the per cent of strong plants is nearly 100.

Thomas W. Cowan, Pacific Grove, Monterey County.—The Blue Lupin was nearly three feet high when plowed-under at the beginning of March, and is far better than either fenugreek or hairy vetch. The fenugreek was only about a foot high and the hairy vetch not quite so much. They were all sown at the same time (in September), but the lupin yielded by far the heaviest crop, and in this respect is more valuable as a green-manuring crop.

C. W. Leffingwell, Jr., Whittier, Los Angeles County.—European Blue Lupin and European White Lupin, planted about middle of September in rather heavy loam in the orchard, have come up well and promise to make a good stand.

FENUGREEK (*Trigonella fœnum grœcum*).—This is an old plant of the Mediterranean region. It is of the clover tribe: an annual which, under favorable conditions, produces a heavy weight of stem and foliage. It is used in the old countries for hay-flavoring; the seed also has aromatic qualities and special uses in veterinary medicine. Several years ago we secured seed and distributed it for trial as a green-manure plant on the basis of satisfactory reports from Algerian experiments. Our last report gives the earlier conclusions of California experimenters. Later reports seem to warrant more favorable conclusions as to its winter growth, and another distribution has since been made. The following are more recent comments:

George B. Pearce, Paradise, Butte County.—Fenugreek started nicely in the spring, but when the hot weather came dried up, although watered occasionally. Growth about six inches. Has started again from self-sown seed.

A. Trost, Palermo, Butte County.—Fenugreek and Snail Clover were sown in January. We had four inches of rain during that month and five and one eighth inches in March, and by the 15th of May they had made a very good growth.

Grant Wallace, Pomelo, Sacramento County.—Fenugreek is inferior to alfalfa in all respects.

W. Croll, Quicksilver, Lake County.—Fenugreek volunteered last winter and made a splendid growth in March and April.

C. W. H. Marriott, Santa Rosa, Sonoma County.—Fenugreek made a good growth and on the roots had tubers as large as small beans.

And. Hastvigsen, Corralitos, Santa Cruz County.—Fenugreek has made a very promsing winter growth, and is now over two feet high. Cattle and horses like it and eat it readily, but it seems to give a bad flavor to the milk when fed to milch cows.

Thomas W. Cowan, Pacific Grove, Monterey County.—On the 30th of September we sowed three strips of ground with Blue Lupin, Fenugreek, and Hairy Vetch. No cultivating was done, but the seed was scattered broadcast and raked in. We had our first rain on October 11th, the amount being 0.27 of an inch. On the 13th the Lupins were above ground; the Fenugreek appeared on the 17th, and Hairy Vetch on the 18th. The contrast in the growth of the three since then is very striking. I have measured the plants to-day (December 20th), and find the Lupins 13 to 15 inches high, Fenugreek 5 to 6 inches, and Hairy Vetch only 3 to 4 inches. Then the amount of foliage in the Lupins far surpasses that of the others, and the plants are much more robust and look as though they would hold their own against weeds, which they have so far considerably outstripped in growth. The Fenugreek can easily be distinguished from the weeds by its brown tint, but the Hairy Vetch is quite lost among the weeds.

OTHER FORAGE PLANTS.

AUSTRALIAN SALTBUSH (*Atriplex semibaccata*).—Our earlier publications have discussed this plant very thoroughly, and as they are still in supply for distribution mention of the plant in this connection will be restricted to the presentation of the latest reports from correspondents to whom we have furnished seed for trial under widely different conditions of soil and climate. Naturally there is divergence in views and experience, but it is important to let this appear. Recent reports from our correspondents are as follows:

Alex. Cuff, Alturas, Modoc County.—At 4,500 feet Australian Saltbush planted on dry, somewhat alkali land, grew thriftily and stands drought and cold weather well. It has kept green longer than alfalfa or other grasses. I think Australian Saltbush preferable to alfalfa for this country.

W. C. Bradford, Arbuckle, Colusa County.—Australian Saltbush planted in the spring on moist, gravelly, clay soil (fair grain land), which had no rain and only about ten days of cool, cloudy weather, grew and fully one half lived through the hot, dry summer. It has no equal as feed for chickens, but stock will not eat it until everything else is gone, preferring dry feed.

Grant Wallace, Pomelo, Sacramento County.—Saltbushes were tested for two years; they do not do well here, making only poor growth or none at all.

Edward Gray Stetson, San Francisco.—The Australian Saltbush, planted in Marin County in several different places (one of them very near the salt marsh), has not amounted to anything, and seems not to be adapted to that region.

L. E. Darling, Dimond, Alameda County.—The Australian Saltbush, which I planted in a hotbed, were transplanted when two inches high to some heavy adobe, and others to dry hillside. That on the hill died out, but that on the adobe covers from three to six feet; it does not spread, however, although it grows all the year round. Hens are very fond of the seeds and leaves in the fall before the grass starts.

A. J. Palmer, Livermore, Alameda County.—The Australian Saltbush, planted on very gravelly land, made rather feeble growth during the spring and summer, but since fall rains began has done well.

L. L. Sanders, Redwood Retreat, Gilroy, Santa Clara County.—The Australian Saltbush has made splendid growth.

John King, Columbia, Tuolumne County.—The Australian Saltbush seed sown in April did not come up until the last of June, but it grew nicely until November. We had some rather severe frosts, but most of it is green and I have strong faith that it is what we want for our waste lands. The cause of failure was the drought for the last two seasons.

W. A. H. Gilstrap, Grayson, Stanislaus County.—An extended trial of Australian Saltbush leads me to doubt the practical value of saltbush in Kings and Stanislaus counties.

H. B. Congdon, Tulare, Tulare County.—Australian Saltbush grew well, but have been unable to secure seed, as the fowls eat it so close; cattle, horses, and fowls all like it.

L. C. Hawley, Hanford, Kings County.—I now have the Australian Saltbush two years old, and under certain conditions it makes a rank growth. I tried to give it a fair trial under different conditions, and my experience is as follows: 1. In good soil with irrigation it makes a rank growth. 2. On bad alkali land it will not grow. 3. It will not grow on dry land without irrigation. 4. It will only grow where barley or alfalfa would prosper. As to its value as a forage plant I can not say, but I have never seen stock of any kind eat it.

Thomas W. Cowan, Pacific Grove, Monterey County.—Australian Saltbush came up well and many of the plants are three feet across. I had a cutting off them in August, but horses did not seem to care for it, either in the green state or in the dried.

E. F. Angus, Creston, San Luis Obispo County.—The Australian Saltbush (*Atriplex semibaccata*), sown in March on land in which most plants dry out, has stood the severe heat of the summer without water and has made a fair growth. I am well pleased with it and intend to plant it more extensively.

H. W. Martin, Cambria, San Luis Obispo County.—Australian Saltbush did very well on poor land.

W Stephenson, Alpine, San Diego County.—The two varieties of Saltbush (Australian and Mealy) did well and the young plants are up thick.

H. H. Gird, Bonsall, San Diego County.—The Australian Saltbush grew about two feet high and was loaded down with seed.

Charles Steele, San Marcos, San Diego County.—The Australian Saltbush plants grown in a box and transferred to the garden have done very well. On a half acre of land on a dry and rocky hillside, the soil of which is not deep and is underlaid with a hard, partially decomposed granite, I sowed the seed produced by the garden plants, but it has not given us any feed for stock, on account of the extreme dryness of the past year.

August Storme, San Diego, San Diego County.—The Australian Saltbush does well, but my horse will not eat it, unless I starve him, and then barely enough to keep alive.

MODIOLA (*Modiola decumbens*).—This plant, which is a native of Chile, was first observed growing freely on alkali lands in Kern County, and many who have grown the plant from our seed praise it very highly; sheep and cows eat it in preference to alfalfa, and improve in flow of milk. It is almost as rich in flesh-forming ingredients as alfalfa; in this respect it is superior to the saltbushes. The plant has a habit of rooting from its prostrate stems, and therefore may be difficult to eradicate. Reports indicate that expectations of its success on dry land may not be justified. The distribution has been very wide and we shall soon have data more fully determining the value of the plant.

L. Seihr, Shasta, Shasta County.—Modiola keeps green here all summer, and as soon as it gets a little rain in the fall it makes a new growth.

J. H. Dobbins, Colfax, Placer County.—Modiola failed in open ground. I have some ready to transplant this fall.

J. O. Titlow, Alameda, Alameda County.—Modiola was planted in ground soon dried out, and as soon as rains ceased plants grew very slowly and formed seeds about midsummer, then began to die. The plants had roots one and one half inches long. When irrigated the plants immediately threw out leaves and runners, but died when irrigation ceased. It was watered irregularly throughout autumn, many plants dying even then; remainder are now growing vigorously with abundant moisture.

Walter Lawson, Tres Pinos, San Benito County.—I have one plant of Modiola, transplanted on June 15th in moist sandy loam, which measures ten inches. I think for moist land slightly alkali it is better than saltbush.

H. H. Gird, Bonsall, San Diego County.—I have twice failed to make the Modiola grow, and under what I think good conditions. Perhaps sowing at just the coldest time in the year may be the trouble.

J. O. Burdick, Valley Center, San Diego County.—Modiola planted in 1898, which was a dry year, did well when irrigated. I think it would make fine feed on damp ground, but it is not good for dry land.

BROWN COLMAN SORGHUM.—As sorghum varieties are proving so valuable for both forage and grain production in the interior valleys, we have grown good-sized collections for trial purposes. The Brown Colman stood first in the trial of a large collection of fodder sorghums at our substation at Tulare. In Berkeley the variety yielded forage at the rate of over thirty-six tons to the acre. The conclusions of other local experiments are as follows:

A. Hain, Ager, Siskiyou County.—Brown Colman Sorghum was plowed-under in summer-fallow April 8, 1900, but I never saw a plant until sowing wheat in October; the sprouts were six inches long and six to eight in a plant. I think the rabbits ate it until other green food came up.

H. Crocker, Milford, Lassen County.—Brown Colman Sorghum stooled out and grew thriftily, and promised well, but on account of the long, dry summer did not seed.

George B. Pearce, Jr., Paradise, Butte County.—Brown Colman Sorghum produced a fine lot of forage, although not much, if any, more than the kind I have been raising. It, however, makes larger and finer heads of seed than the common kind, which is quite an item in its favor.

Charles W. Bingham, Lakeport, Lake County.—Brown Colman Sorghum grew well, making more fodder than the saccharine variety commonly grown here, appearing to be identical with Kaffir Corn, but produced no seed.

T. Bonta, Elk, Mendocino County.—Brown Colman Sorghum planted a mile from the ocean came up, but did not make any growth; too cool and foggy.

William N. Russell, Los Gatos, Santa Clara County.—Brown Colman Sorghum made indifferent growth, spreading out on the ground and not making the canes which the other erect varieties made.

C. C. Wulff, Watsonville, Santa Cruz County.—Brown Colman Sorghum was sown April 10th; made some growth, but too slow, all the summer through. Corn by the side of it produced ten times as much fodder.

C. D. Guilford, Creston, San Luis Obispo County.—Brown Colman Sorghum was planted April 1st where Early Amber has been a good crop, but now (October 7) it is about a foot and a half high.

C. W. Leffingwell, Jr., Whittier, Los Angeles County.—Brown Colman Sorghum planted on unirrigated ground made no better growth than the common varieties.

PASTURE GRASSES.

Our effort to secure the introduction of grasses for either of two purposes, to improve the pastures in the fall and winter and to maintain life in the roots at least, during the long dry season, has continued, and a number of species new to the State have been distributed. In addition to the full discussion of the subject in earlier reports, the following notes are of interest:

Guill Bros., Chico, Butte County.—Reed Fescue (*Festuca arundinacea*) did not make a very rank growth in spring and died down in the summer, but this fall sent up green shoots after the first rain. I think it will make a good pasture grass with irrigation.

T. E. Rice, Livermore, Alameda County.—The Tall or Reed Fescue seems to be excellently adapted to this locality. During the hot weather in June part of it dried out, but what was left formed bunches from two to four inches in diameter. The outside blades kept dying, but the center was always fresh and green.

W. F. Waterman, Berrios, San Luis Obispo County.—Reed Fescue planted on sandy mesa made no stand, the ground being too dry for it.

Edward Gray Stetson, San Rafael, Marin County.—Shrader's Brome Grass planted in good soil and cultivated grew well; sown broadcast in two different places it has not held its own against the natural grasses. A bunch of it was transplanted to a bare, hard hillside, denuded of soil, where there was no other grass to interfere with it; and this bunch has kept alive during two summers and seeded, without water and without spreading.

A. N. Hunt, Arcata, Humboldt County.—*Bromus inermis* has not come up to expectations. It was sown in April on sediment soil ten feet deep, but did not seed, and grew slower than the rye grasses. We tried it in three different ways: in pasture with oats and clover, in orchard with a little rye grass, and in the orchard alone. The latter has made the best showing, being about eighteen inches high when we cut it. It may be that it is too cold here for it, as we are two miles from the coast.

T. E. Rice, Livermore, Alameda County.—Giant Rye-Grass, Large Water-Grass (*Paspalum dilatatum*), and Reed Fescue all grew well, but did not seed this year. Tall Fescue seems to stand more drought than any grass I have tried. If not cropped off too short it will furnish green feed the year round. Gophers are very fond of the roots, however, and kill out a great deal of it.

L. L. Guss, Oakley, Contra Costa County.—Large Water-Grass made a good growth. When not protected it blows out by the roots in this loose sand, and is hard to get started.

W. Croll, Quicksilver, Lake County.—The Ray-Grasses all did well.

Guill Brothers, Chico, Butte County.—Italian Ray-Grass made a much better growth than the perennials. It will help to improve our spring and fall pastures, but we do not think will aid the summer pastures.

Albert F. Etter, Briceland, Humboldt County.—I have been experimenting considerably with grasses for sowing on land where timber has been slashed and burned off Have tried most of the tame grasses and our wild grasses; after five years I find that the old Mesquit (*Holcus lanatus*), that has been tried so much, will hold its own remarkably well. I have also found, what others have also found, that the native grasses of a country may be better than imported ones. Such is the case with our mountain "bunch grass" and another species of leafy nature. They head somewhat like Red Top, though more delicate, and take a hold on the ground like blue-grass. I believe these two are the very best grasses I have sown. They make a strong, enduring turf, and hold the soil from washing, thus eventually making a seed-bed for other grasses and clovers. They also stand almost any drought, and I am surprised how readily they catch on a burning. They also grow in what seems to be the very poorest land. This experiment was made on land that is somewhat shaley and moldy, and it takes time to get a turf established on such.

THE SUBSTATIONS.

By Charles H. Shinn, Inspector.

The following brief review of the principal work done at the substations since 1898 will be followed in subsequent publications by a more detailed account, with tables and illustrations:

There are four culture-substations devoted to orchards, vineyards, and general experimentation. Three were established in 1888 and 1889, and one later. There are also two substations devoted to the growth of forest trees, which were originally established by the State Forestry Commission and were transferred to the University in 1892. At first, carried on by a small State appropriation, they are now maintained from the general fund of the University.

During the past three fiscal years the work of the substations has been concentrated upon fewer lines than formerly, partly as the result of successive years of deficient rainfall; still results of considerable local and general importance have been reached. The coöperation of the patrons and foremen has been excellent, and few changes in the working force have occurred. Expenses have been very considerably reduced, the total amount now spent annually upon the six outlying stations being nearly $2,000 less than in 1897. The money thus drawn from substation work has been expended in various investigations made by the Central station. Necessarily, some of the operations of the substations have been much modified by this reduction of expenses, which has fallen chiefly upon the Southern Coast Range substation near Paso Robles and on the forestry substation near Chico. But the demands made by the public for information and for such aid as falls within the legitimate province of the substations are yearly increasing. Shipments, on a large scale, of plants, scions, seeds, etc., were made in 1901 to the new experiment station at Benguet, Philippine Islands, to Tuskegee Institute, Alabama, to Arizona, to Alaska, to British Columbia, to South Africa, to the Hawaiian Islands, etc.

THE FOOTHILL CULTURE SUBSTATION.

At all of the substations experiments have been carried on for three seasons with the so-called "gluten," macaroni, or hard wheats sent out by the U. S. Department of Agriculture, and full reports have been made to the Division of Chemistry, which has charge of the matter. These coöperative experiments, in which a large number of experiment stations have been interested, are still in progress and are of much importance. The quality of the gluten wheats grown at the different substations varied considerably, Amador showing the greatest change and increase of starch; Tulare, Paso Robles, and Pomona were better, in the order named. The change observed in the original No. 3283

Plate 15. Foreman's Cottage—Foothill Substation.

Theiss wheat at Pomona in two years' culture was slight, but that grown at Amador in that time advanced far toward White Australian. The hard Algerian wheats received from Dr. Trabut suffered less deterioration at Pomona and Paso Robles than at Tulare and Amador. The plants of all the hard wheats grown at Tulare have tillered more and yielded better each year than the previous year. Bulletin No. 3 of the U. S. Bureau of Plant Industry is devoted to hard wheats and the areas adapted to their culture.

All previous reports, from 1889 to the present time, have shown the value and interest of this location for the future horticultural development of the Sierra foothills. After thirteen years of continuous work at this remote point, difficult of access and situated in the midst of a community whose attention has been chiefly devoted to mining, the growth of the fruit interest is very marked, and the horticultural future of the region seems assured.

This substation is on the frontier, and its observations have been strikingly new. Its first foreman, a skilled collector, sent many of the native plants of the region to European herbariums. Its orchards and vineyards, embracing a very large number of varieties, have scattered scions, buds, and cuttings of new and promising sorts among the farmers of Amador and adjacent counties, at the rate, in recent years, of from four to five thousand items each season. It has illustrated, year after year, the proper use of fertilizers on the light granite soils of the Sierra foothills; has introduced improved methods of irrigation; has aided to develop the culture of figs, olives, grapes, and other fruits in this region; has devoted especial attention to all the more hardy deciduous fruits, introducing many promising new sorts; and has tested an enormous number of cereals, forage crops, grasses, and various small cultures. For two seasons past the olive oil produced at this substation has attracted general attention for its high quality.

Changes and Improvements.—Since 1898, the date of the last report, Mr. J. W. Neal, foreman of this station, has been transferred to Paso Robles, his former home, and Mr. J. H. Barber of Paso Robles was appointed to Amador, taking charge in July, 1901.

The water system, which was utterly inadequate to the needs of the substation, has been improved by the installment of a larger turbine and pump built by Knight & Co., at the Sutter Creek foundry. A new pump-house has also been erected at the ditch. With a new and larger pipe to the reservoir, the pump can be used to irrigate all deciduous orchards on Reservoir Hill, some six acres, and also several acres of alfalfa to reduce the expense of hay. Its capacity at full stroke is ten miner's inches, or ninety gallons per minute, and the turbine is twelve horse-power. The illustration (Plate 16) shows the new pump-house, which is large enough for use as a tool-house and workshop. The turbine also runs circular saws and a grindstone under this roof.

An office, 12x20 feet in size, has been built, containing also the station library and the seed-room. This was necessary, as the foreman's cottage is not large enough for these various uses, and also in view of the manifest desirability of separating the official work from the foreman's home. This, like the pump-house, was built of mountain pine, by day labor. It was "set on pans" and on stone-posts, and is rat-proof; a very essential matter here.

Minor improvements include new fences, road-making, bridge-building, the removal of many rocks by blasting and otherwise, the erection of a tank-frame and water-tank, and a good deal of repairing and reconstruction.

Seeds from the U. S. Department of Agriculture.—Extensive culture experiments have been carried on during the three years upon plants of which seed came, under number, from the Section of Plant and Seed Introduction of the Department of Agriculture at Washington. These involved some four hundred different cultures, many of which were several times repeated on various soils and under diverse conditions. The results were in many cases most promising. No part of California is in greater need of the continuance of extensive culture tests, by which the adaptability of the Sierra foothills to a large number of new crops is indicated by the work heretofore done. More extensive tests are required, and a wider publication of results. The following brief résumé of culture notes is all that the limited space permits at present:

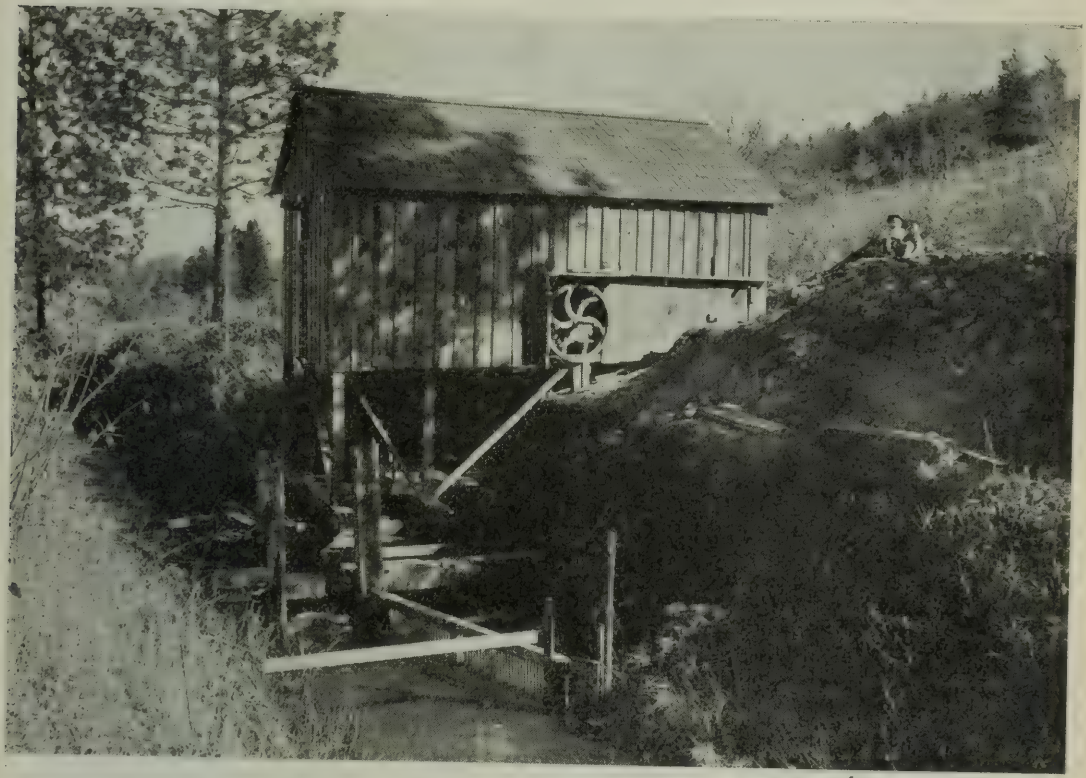


PLATE 16. THE NEW PUMP-HOUSE AND WORKSHOP.

Tests of muskmelons and watermelons in great variety, American, European, and Turkestan sorts, give better results with watermelons than with muskmelons, and show the need for some irrigation for melons on the hill slopes. Stock melons are valueless here.

Tests of vetches, on quite a large scale, conducted here for ten years with seed imported by the Central station, and with Department of Agriculture seed for the past three years, have included all known types. *Vicia narbonensis* (No. 1509), sown November 6, 1899, blossomed May 25th, and yielded, without irrigation, at the rate of 25,400 pounds per acre. *Vicia villosa*, however, has done even better under similar conditions, yielding at the rate of 32,670 pounds per acre. The following vetches can be highly recommended after the substation's experience of from three to ten seasons: *V. villosa*, *V. sativa cordata*, *V. sativa*, *V. narbonensis*, *V. bythinica*, and *V. fulgens*. Plots of *V. villosa* on good slate soil, but unfertilized and unirrigated, have yielded in seasons of heavy rainfall, such as 1889–90 and 1894–95, as high as twenty tons of fodder to the acre, and this very valuable plant is now to some extent naturalized in the pasture and by the roadsides at the substation.

The well-known Windsor and other broad beans of Europe (Nos. 2064, 2065, 2066, 2375, and others of the inventory), have thriven on slate soil when sown with the first rains, and are a profitable forage crop. Only the earliest of the soy beans can be grown. The March rape, the Turkestan alfalfa, the Chick pea or garbanzas, the Tambor and Voronezh millets, the brewing barleys, and the hard wheats have done extremely well.

Fertilizer Experiments.—No problem of the district is of more importance than the improvement of the coarse sandy soils (decayed granite and diorite from the higher ranges). The late Dr. Myers, of the Nitrate Propaganda, became interested in this work, and furnished the needful fertilizers, which subvention has been continued by his successor. Large plots of wheat, oats, and barley have been grown for hay several successive seasons. Hay is one of the principal crops in this region; very little grain is grown. To one series of fertilized plots, sodium nitrate, muriate of potash, and Thomas phosphate were applied, raising the value of the yield from $12 to $25 per acre. The average cost of fertilizers on this scale was $5 per year; soil, granite and poor. In another series, on red slate soil, the application of fertilizers worth $4.20 per acre raised the value of the resultant crop from $17.16 to $28.33. Barley hay on slate soil, by the use of $5.20 per acre in fertilizers, was made to show an increase of value of from $13.50 to $26.66. On a very poor granite soil, which ordinarily has yielded but one quarter of a ton of hay to the acre, a moderate use of nitrate and phosphate raised the yield to one and a fourth tons. The crops upon the slate soils were proportionately increased. (These experiments are elsewhere more fully described; pages 89–92.) Fertilizer experiments were commenced here in 1895–96, and have been continued ever since. The results are more immediately manifest in respect to hay crops; but their value in regard to fruits, vines, and vegetables is equally important.

European Lupins for Green-Manuring.—The experiments continued for several years show conclusively the adaptation of this crop to the district. Several species, but especially the large white and the blue, when sown with the first rains, blossom by March and can be plowed under with ease before the end of the rainy season. The fly which has sometimes injured the stems of lupin plants here, has done little injury for two seasons. But no plants are more subject to the ravages of the well-known "jack-rabbits" of the Sierra foothills, and where these are plentiful, lupins can be sown only inside of rabbit-proof inclosures, or on so large a scale as to defy their assaults. The greater number of garden and field crops suffer to a larger extent than is commonly supposed from rabbits and squirrels, and only the gradual "settling-up" of the country seriously lessens these pests.

The Orchard and Vineyard.—Upon a general review, the condition of the trees and vines is very satisfactory. A new apple orchard, planted on the northeastern slope of the highest hill on the tract, is nearing the bearing age. Every tree here is of a variety new to the district; the scions were obtained from England, Germany, France, Canada, British Columbia, and Australia, as well as from many collectors in the United States, and represent a very promising total.

PLATE 17. CORREGIOLO OLIVE TREES ON A TERRACE.

Some orange and lemon trees have been planted on the most sheltered spot that can be found.

The fig collection has been considerably increased, especially by all the Roeding varieties of Capri or wild figs.

The olives have borne large crops and have attracted much attention in the district, so much so that a separate bulletin on the olive in the Sierra foothills would seem desirable. After years of experience at the four substations in the counties of Amador, Tulare, San Luis Obispo, and Los Angeles, as well as at the Central station at Berkeley, no collection of olive trees planted by the station promises so much profit as does this one. Even here the first-rate varieties which can be generally recommended to growers are few. The best all-around variety at the substation is the Manzanillo, with the Mission a good second. The most profitable oil varieties are Uvaria and Atroviolacea. These four varieties do fairly well with care on the granitic soil, when it is deep, but they do better on the slate soil.

Grapes are being planted in the foothills more and more each year, so that the value of the large experiment here is very plain. After long experience, the substation recommends for dry red wines, Aramon (short pruning), Carignane (short), Mataro (short), and Tinta Val de Peñas (half-long). For dry white wine, Burger (short), Semillon (long), Sauvignon (short). For sweet wines, Palomino (short or half-long), Boal de Madeira (half-long), West's Prolific (short), Tinta Amarella (half-long). For table use, white, Luglienga, Chasselas de Fontainebleau, Muscatel, Palomino, Muscat of Alexandria, White Tokay, Verdal, Almeria; red, Barbarossa, Flame Tokay, Zabalkanski; black, Cinsaut, Aramon, California Malvoisie, Tinta Amarella, Black Muscatel, Black Morocco, and Emperor.

THE SOUTHERN COAST RANGE CULTURE SUBSTATION.

The substation near Paso Robles has cost more in proportion to positive results than any other station. It was located on soils typical and varied, east of the Salinas, in a region which in 1888 was just changing from pastoral to agricultural conditions. All the newcomers, unused to the peculiar problems of soil and climate here, wasted large sums of money on unsuitable crops. The substation necessarily did the same, keeping record of results, so that in many cases these must now be recognized as final.

When the substation was established, the people of the whole upper Salinas region were planting vines and trees. The country was said by some to be semi-tropical and to be adapted to olives, figs, oranges, and lemons. Its adaptation to all the ordinary deciduous fruits of the Bay counties was generally believed to be excellent. In order to test this fully, the substation planted large collections of trees and vines on different soils, gave them the best of care and culture, and has arrived at conclusive results, which will be printed *in extenso* in a forthcoming bulletin (No. 141). Experiments with cereals, grasses, and forage plants have been continuous, and a large variety of small cultures has been thoroughly tested on different soils.

The "hardpan," both physical and calcareous, has received especial attention, and moisture determinations have been made in different seasons upon soils occupied by various crops and different kinds of trees. Fertilizer experiments have also been carried on, particularly on the light granitic soils.

Changes in Substation Management.—In July, 1901, Mr. S. D. Merk of Paso Robles was appointed patron in place of Mr. F. D. Frost, and Mr. Neal became foreman in place of Mr. J. H. Barber, transferred to Amador County. In February, 1902, Mr. Neal resigned, having been appointed to U. S. station work in Alaska, and Mr. John Ooley, who has before been workman in charge at this substation, took his place. The regular running expenses have been greatly reduced by the removal of nearly all the older parts of the orchard and half the vineyard (all on poorer soils), and the bringing of a number of experiments to conclusion.

Climate.—A careful comparison of the rainfall records kept at the substation and at the adjacent town of Paso Robles shows that while the average yearly rainfall for the four years after and including 1887–88 was over twenty-one inches, the average for the next four seasons from 1897–98 has been less than thirteen inches. The average of fifteen successive seasons was sixteen inches.

The records show that the first crop has been more or less injured by late spring frosts in nine out of thirteen years. There have been as many as fifteen killing frosts in March and April. One year there were forty-two such frosts between September and May. The warm, bright days of February "bring out" fruit blossoms astonishingly, and no method which science or experience could suggest has been able to retard the development of this blossoming. In this country of rolling hills, strong wind currents, and low winter temperature over a large area, no smudging in the orchard is effective.

Results of Orchard Experiments.—The detailed results of work with deciduous fruits here, and over a large area east of the Salinas River, will be given in a forthcoming bulletin; but briefly stated, the "hardpan" soils, both calcareous and physical, east of the river, are totally unsuited for fruit culture, although, when young, grapevines thrive, and, if the blossoms are not frosted, peaches and nectarines bear fairly well. At their best, orchards on such soils yield only small crops of low-grade fruit, suitable for family use, but not profitable. The native oaks do well on hardpan, as the roots penetrate to a considerable depth; but fruit trees are not as well able to do this. On the heavier and deeper soils, such as the brown and black adobes, pears and apples often do very well, and, unless the location is subject to late frosts, the stone fruits, excepting cherries and European plums, are fairly successful. On such soils some excellent vineyards have been established.

The young orchard, planted in 1897 on black and brown adobe soils, as well as an old orchard planted at various times since 1889 on swale soil and brown adobe, possess at present an especial value for the district. Taken together, they constitute the most thrifty orchard of apples and pears known to us on the east side of the Salinas River, over an area of more than three hundred square miles. The young orchard on the black adobe is altogether the best, and is just beginning to bear fruit. A number of apples new to this district, and generally new to California, fruited for the first time in 1901. The apple season here has been extended by one new California seedling, Gold Ridge Winter, a large and excellent fruit which kept until late in December. As such varieties as Yellow Newtown Pippin have not kept later than November 1st (as grown at the substation), the value of this introduction is considerable.

Experiments with Seeds from the U. S. Department of Agriculture.—Here, as at the other stations, a large number of cultures during the past three years have been devoted to plants the seeds of which were sent out by the Division of Seed and Plant Introduction. The location is so poorly adapted to general cultures that only about a quarter as many different sorts were tested here as at Amador, and nothing made a great success excepting some of the cereals, the new saltbushes, the watermelons, and a few lupins on the adobe soil. The muskmelons and squashes failed; the Turkestan alfalfa required irrigation; Jersey kale, March rape, and Russian sunflowers, planted with the first rains, did very well until the summer heats came. Hairy vetch, sown with rye, yielded very well, but no other vetch succeeded here. In some seasons lentils have yielded good crops; in others, they failed utterly.

Vegetable gardens, started very early and planted to only the most hardy species, grow fast during the winter and spring, and the crops are of high quality. But the vegetables which mature slowly require irrigation, and some need shelter from severe late frosts and hot sun.

In years of ordinary rainfall the growth of cereal plots is excellent and rapid on all soils, no finer grains having been produced at any of the substations than the wheats, barleys, oats, ryes, and spelts grown here in great variety three years out of four since 1889. The gluten wheats sent out by the U. S. Department of Agriculture have done remarkably well here.

Fertilizer Experiments.—On adobe soil of good quality, the application of nitrate of soda only increased the yield of hay from 2,200 pounds to 3,340 pounds per acre, but the weight of grain was raised from six and a quarter centals to thirteen and three quarters centals per acre. Estimated in money, the application of $3.60 worth of nitrate added $5.50 worth of hay, or $7 worth of grain to the crop per acre.

When drilled on light soil (granitic underlaid by hardpan) several late frosts checked the growth, and all gains were lost. In another experiment on light soils, with broadcast plots, the amount of the crop was increased forty per cent, the profit being rather more than was the case with the heavy soil.

Fertilizers applied to vineyard and orchard showed good results in growth of trees, but thus rendered them more susceptible to frosts, excepting in the case of the hardier apples and pears in the young orchard, where the gains were distinctly noticeable. As the trees were not yet of bearing age, this was merely fertilizing for future results.

Lupins for Green-Manuring.—The experiments made here with European lupins have been quite satisfactory, both on the granitic soils on hardpan and on the better soils in the young orchard. Some seasons early frosts prevent the lupins from making a start. But if sown early, they become rooted before the severe frosts, grow fast and then can be plowed-under in spring. In such seasons the first blossoming is about the end of January, and the second, or side-shoot blossoming, is from March 10th to March 15th. The large European lupin has been much the best spècies here. Its growth on the light soil has been from eighteen inches to two feet high, well branched; and on the heavy soil, about fifteen inches and less branched. This smaller size on the better soil is due to its later starting in the early winter.

Success with Saltbushes.—One of the things done by this substation, the introduction of Australian and South American saltbushes, for dry-land forage plants, is of extreme economic importance to the people of a district in the Coast Range larger than the State of Connecticut. The first valuable introduction was the well-known *Atriplex semibaccata.* During the season of 1897–98, when the total rainfall was but a little more than four inches and all the other field crops failed, this plant grew all summer, yielding at the rate of one and a half tons of dry forage, or coarse hay, per acre, and five hundred pounds of seed, also of high food value. This showing was so remarkable that it was difficult to believe such results, but the experience of three subsequent seasons confirmed them in every particular.

Saltbush seed was distributed throughout the entire district, to every farmer who would agree to test it. More than two hundred persons sowed seed, and in every case made a success of the crop. Its value was greatest on the light and hardpan soils, as reports from all parts of the county, particularly on the east side of the Salinas, clearly showed. The area devoted to saltbush is steadily increasing. The plant shows some ability to naturalize itself in pastures and by roadsides, but the well-known "fox-tail" chokes it out, as it also does the wild oats, clovers, and other native forage plants. Saltbush, however, can hold its own with our native weeds. In 1900, at the substation, saltbush under ordinary field culture yielded at the rate of three and a half tons of dry fodder per acre. One special advantage of the crop for this district is that, if cut back or fed off about the middle of October, it makes six or eight inches of new growth by the middle of January, long before our native forage plants in this region on similar soils are fit for pasturage.

PLATE 18. ATRIPLEX NUMMULARIA.

During the past three years, another saltbush, *Atriplex nummularia,* (Plate 18) has come into deserved prominence at this substation. This species grows tall and is considered one of the most valuable of all in Australia, where it is extensively propagated from cuttings. It is a browsing plant chiefly and does not furnish hay such as that of *A. semibaccata.* But its drought-resistance is enormous, and it is probable that if widely planted, its value on cattle ranges here would equal or surpass that of the latter. Cut once, December 11, 1901, the plants, then two years old, yielded at the rate of over seventeen tons of excellent green forage per acre. Two cuttings are practicable here, giving a total of from twenty to twenty-five tons of green feed for sheep or cattle. *A. nummularia* here is far superior to *A. halimoides*, *A. vesicaria*, and the other tall Australian species tested. Fifty plants, a year old, will furnish cuttings sufficient to plant an acre of ground. The cuttings, of old wood, made six or eight inches long, should be rooted in boxes of sand, from which they can be transplanted in rows four feet apart, if on poor soil; on rich soil they need more space.

Atriplex pamparum and *A. cachiyuyum** are two tall-growing species of saltbushes, new to North America, and natives of Argentina. They have shown much endurance of droughts and frosts, and produce a large amount of excellent forage on extremely poor soils. As far as tested, they yield somewhat less than *A. nummularia;* but further experience may show them to be more valuable than that species. The plants have not yet seeded here.

Two rhagodias, *R. spinescens inermis* and *R. linifolia*, have shown great forage value at this substation, and also great endurance of drought and frost, besides containing less salt in their leaves, so that horses, which do not always like the atriplexes, are more fond of the rhagodias. These plants promise more value in the Paso Robles region than at Tulare, where, while growing well, the yield is not proportionately as profitable. This is especially so in the case of *R. linifolia*, which makes a larger plant in the Coast Range on poor soils, than at the Tulare substation on alkali land.

At present, the only plantations of saltbushes existing in the region outside the substation consist of *Atriplex semibaccata*. The largest of these is fifteen acres in extent, near Cholame, but there are many of one acre and upward. The rhagodias and the tall saltbushes herein recommended can very easily be naturalized over a wide area, and with the prostrate *A. semibaccata* will not only enable farmers to carry their livestock through dry seasons, but will afford more dry-land forage per acre than any other plants tested at the substation.

SAN JOAQUIN VALLEY CULTURE SUBSTATION.

The results of work of the past three years at the Tulare substation have to some extent appeared in several publications, such as Bulletin No. 133. Several large charts showing the history of the region in relation to alkali have been prepared, but, with the data relating to them, await fuller publication. No changes have occurred among the local officers of the substation.

Improvements.—A new well has been sunk in the northeastern five acres of the twenty-acre tract, and a good pump placed therein. Water for the necessary irrigation in dry years and for continued reclamation of alkali spots is raised by horse-power. The well on the south side

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*There two species are now stated to be identical.

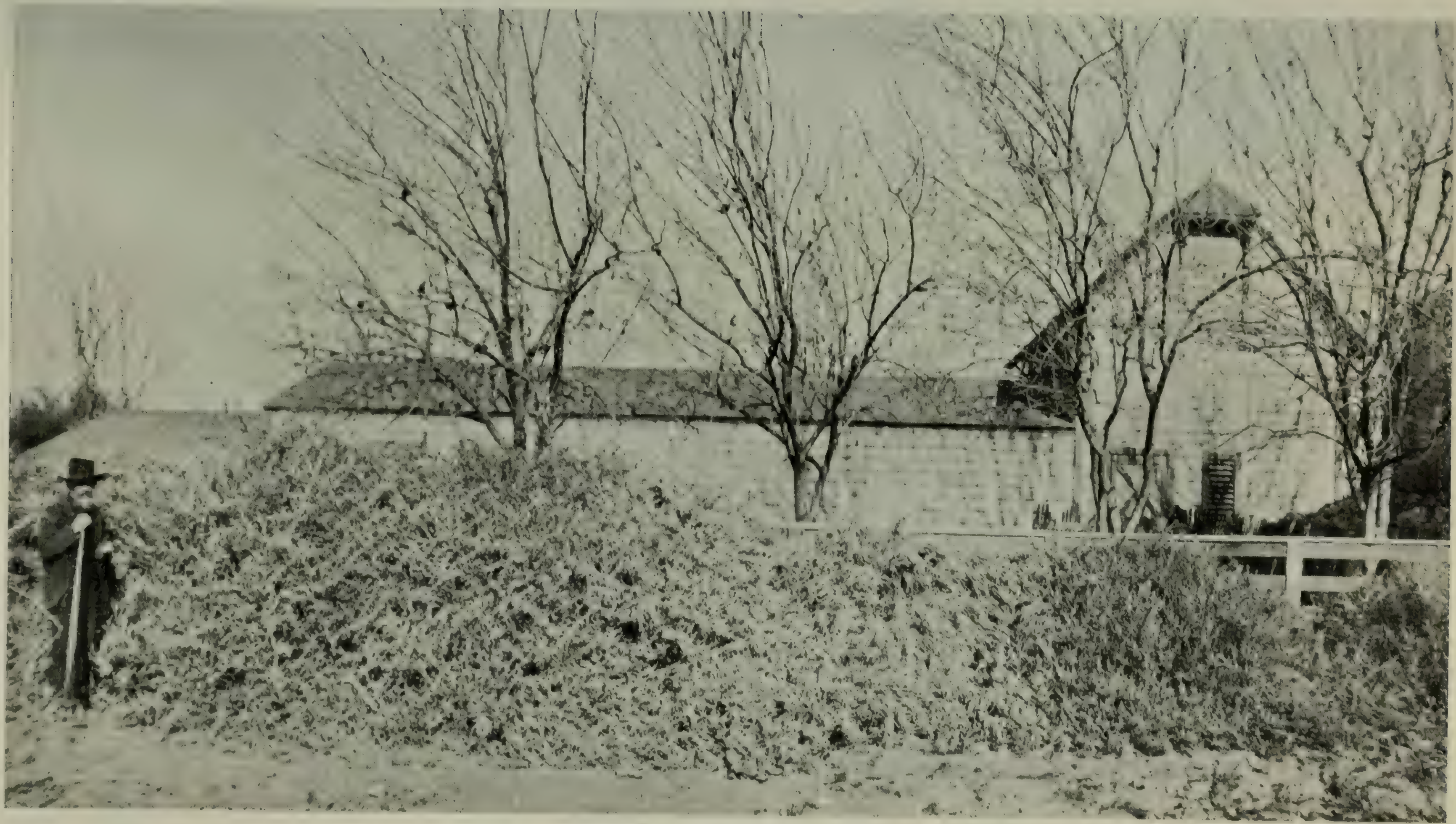

PLATE 19. ATRIPLEX PAMPARUM.

of the tract could be made to supply this corner only by an expensive arrangement of movable pipes, and it did not furnish sufficient water for the work. The substation is now to a large degree independent of the seasons.

Saltbushes.—For two seasons there have been grown at this substation two new species of *Atriplex* from Argentina, *A. pamparum* and *A. cachiyuyum*, seeds of which were sent by President Rocca. The food-value of these two species, as shown by analyses made at the Central station, is quite equal to that of the famous *A. semibaccata*, familiarly called "Australian saltbush"; in some respects, indeed, their food-value is greater. These two new saltbushes grow large, tall, and compact. In this soil single plants in eighteen months, without irrigation, covered a circle ten feet in diameter and were ten or eleven feet high. If cut, or browsed down, young growth is rapid, and a great amount of forage is thus furnished. The value of these plants to the alkali region will be enormous as soon as seed can be obtained for general distribution. At present, plants can only be propagated by cuttings.

The strong growth of *Atriplex semibaccata*, *Rhagodia spinescens inermis*, and several other saltbushes on the alkali soils here continues to attract attention and causes correspondence from all parts of the world. The entire crop of the substation seed, which is over 1,000 pounds yearly, is demanded by seedsmen and experimenters. Since 1892 this substation has produced upward of eight thousand pounds of seed of various *Atriplexes*, and this large amount has been to a great extent distributed to farmers.

After several more years of experiment, a number of saltbushes which for a time did well, can be no longer recommended. *Atriplex leptocarpa* has no advantages over *A. semibaccata*. *A. halimoides* and *A. vesicaria* are less desirable than the new South American species. *Rhagodia linifolia*, a most attractive and even showy plant, is too small here for profitable pasturage, although, as elsewhere noted, it has value in the foothills of the Coast Range.

Experiments with Cereals.—The work of the Tulare substation since 1889 with cereals has been extensive. Every variety which could be obtained by the Central station has been grown here, in some cases for several seasons. Collections have been shown at fairs and boards of trade in the San Joaquin Valley, in Los Angeles, in San Francisco, and elsewhere. Fine cereals have been grown here on the less alkaline soils, while on the strong alkali land in process of reclamation the comparative growth of different cereals has been a most important practical test.

One of the most gratifying illustrations of work with cereals here is afforded by the local history of a wheat sent to the substation in 1896, a German wheat originally, but grown at the Central station by Mr. Klee under the name of "California Spring." This yielded so well, and proved so drought-resistant, that it was locally distributed and became popular in Fresno and other counties. Mr. Albert Nelson, of Tagus Switch, Tulare County, took up the culture of this variety on a large scale. The milling companies tested it, and a number of carloads of seed wheat were bought from Mr. Nelson and others, in 1900 and in 1901, to send to the Coast Range, and also to various districts in the San Joaquin and Sacramento valleys, to take the place of Sonora and other varieties.

The list of cereals grown at the substation, exhibited and very widely distributed from time to time, includes fifty-nine wheats, seventeen barleys, ten oats, five ryes, and five spelts, besides about forty varieties of various cereals received under numbers from the U. S. Department of Agriculture.

Seeds from Washington.—This substation, on alkali soil, is not adapted to a large range of crops, and therefore the list of seeds from the Section of Seed and Plant Introduction sent here was necessarily limited. The wheats, barleys, millets, and other cereals sent out by the Department were grown, and seed saved for distribution. The broom-corn millets were excellent and highly drought-resistant. An improved form of furze withstood alkali quite as well as alfalfa. The vetches were not a success, owing to their non-resistance to the carbonate of soda in the soil; they grew well at first, but failed when the hot weather came. The cow peas, flat peas, and nearly all the legumes are without value on the alkali soil. Goat's rue stood the drought well, but grows with difficulty in alkali. Sainfoin and sylla stand a considerable degree of alkali; they have been tested for about eight years in this place. The sorghums did remarkably well, and seeds of Early Amber, Folger's Early, Colman, and Collier were locally distributed. The importance of the sorghum crop for fodder in this district is steadily increasing.

Orchard and Vineyard.—After thirteen years of experience, the substation orchard has been reduced in size and confined to those fruits which do well here. It is by far the best and most successful orchard on this class of soils in this district, showing the value of constant care and the use of gypsum on spots of alkali as fast as they appear. Peaches, nectarines, pears, quinces, apples, plums, olives, figs, and pomegranates yield the principal crops here. The best-bearing plums are of native American varieties, not Japanese. Prunes do well on less alkaline soil, but not here. No fruits do better year in and year out than figs, pomegranates, olives, and pears; apples are not of high-class quality here, and the late frosts sometimes injure the peaches and some varieties of olives. Pendulina, Manzanillo, Mission, and Rubra are excellent bearers, withstand frost well, and generally ripen by the first week in November.

The vineyard is very useful and valuable. Many thousands of cuttings are annually sent out from here; and as vine-planting is rapidly increasing in the San Joaquin Valley, this large collection proves of constant service to the region. The location is in sandy soil, more or less alkaline. Mr. Forrer's long experience enables him greatly to aid inquirers respecting varieties to plant and treatment to give the vineyard. He recommends as prolific bearers and strong growers here, the following wine grapes: Tinta Val de Peñas, which ripens the first week in September; Lagrain, which ripens about the same time; and, ripening later, Grenache, Carignane, Alicante Bouschet, Aleatico, Mondeuse, Charbono, Cinsaut, Aramon, and Refosco (Crabb's Black Burgundy). Beclan is an immense bearer, but not a thrifty grower, and so should be grafted on some good stock. Mourisco branco is inclined to shy bearing. Mourastel is one of the heaviest and most regular bearers here, yielding from 50 to 65 pounds per vine every year. The well-known old Mission yields large crops and is still a good deal planted. Verdal, even in quite strong alkali soil, has grown well and bears heavily. Bolgnino, Tadone, Burger, Malmsey, Bebà, Palomino, and a few others are heavy bearers. Among table grapes, all of the Muscat type, Flame Tokay, Emperor, Black Morocco, Bakator Rouge, Napoleon, the Cornichons, Almeria, and others are of the finest quality. Some of the leading wine grapes, such as the Golden Chasselas (Palomino), are also prominent in this class.

Alkali Reclamation.—Since the last report was issued, a large range of cultures has been maintained for three years upon about ten acres of land. Cereals, particularly gluten wheats, beets and garden crops, clovers, vetches, grasses, lupins, flaxes, and representatives of all the leading families of plants have been tried on different plots. Good wheats have been grown each year upon the originally strong black alkali plots in the northwestern portion of the tract. The adjacent lands, which were used successfully for cereals fifteen years ago, are now, by reason of the rise of alkali, unfit for any crop without heavy applications of gypsum; but these plots, treated and worked on substation methods, have yielded better and better crops of wheat each season for the past three years.

Experiments with cucurbits showed failure with watermelons and muskmelons in every case, but summer squashes grew fairly, and the Tsama melon (stock-melon) from South Africa did well. Some of these were tested without irrigation; others received sub-irrigation from sunken barrels. Bulletin No. 133 gives full notes upon a wide range of cultures upon these alkali soils.

Grasses and clovers do very poorly as a rule on the strong alkali, the chief exception being the bitter Bokhara clover (*Melilotus alba*), which, if "improved" by some hybridizer, would be of enormous value to such districts, as it withstands frost, drought, and alkali to a remarkable degree. The common snail clover (*Medicago turbinata*) and the wild "bur clover" are valuable here if sown early. Texas blue-grass (*Poa arachnifera*), the smooth brome (*Bromus inermis*), the Italian rye-grass (*Lolium italicum*), and the well-known "Gramma-grass" stand the dry summers here better than any other grasses among all those tested during many successive seasons. The Turkestan alfalfa, although better than the common sorts, needs some irrigation to keep it growing all summer. Esparsette and many other dry-land forage plants of note elsewhere, are not able to stand the combination of drought, frost, alkali, and summer heat without some irrigation.

SOUTHERN CALIFORNIA CULTURE SUBSTATION.

The work of this substation has been of enlarged local interest since the organization of many farmers' clubs and farmers' institutes in the vicinity, and meetings have frequently been held on the grounds. Correspondence and the number of visitors have increased, and the demands upon the foreman's time are greater than ever before.

In some ways the expenses of the place are higher, chiefly owing to the increased cost of water for irrigation and the greater number of small cultures necessitated by extensive testing of new crops, especially plants and seeds sent out from Washington.

The line of experiments, instituted ten years ago when the substation was established, with the leading deciduous fruits of Northern California, has been brought to a close in some particulars, as at Paso Robles, and a final report of results, in bulletin form, seems necessary. The views formerly held by growers in this region respecting deciduous fruits must be greatly modified under present conditions. Experiments with citrus fruits, and with many deciduous fruits, continue and are developing interesting results, some of which appear in Bulletins Nos. 136 and 137.

The most economical method of using irrigation water has been one of the most important lines of recent work, and continued tests of plants on the alkali spots of the ten-acre tract have formed another.

Changes and Improvements.—Hon. S. N. Androus was appointed patron in March, 1900. Improvements have been few and not expensive, excepting additions made to the water-system. The substation formerly received a free supply of water delivered by gravity from flowing artesian wells. Owing to drought and greatly increased demands upon the water-supply of the whole valley, the natural water-level appears to have changed; at least, no more water was obtained from these wells, and, in common with many land-owners in the vicinity, the substation suffered severe losses. The well on the substation tract, used for house-supply, was sunk deeper, and a good gasoline engine and pump purchased, but the supply obtained has not yet proved sufficient for the needs of the soil. It will be necessary to sink a larger and deeper well, or to continue purchasing water from an irrigation company, as heretofore, whenever a large supply is needed. The restoration of former water conditions in the valley does not appear to be imminent.

Climate.—The rainfall in the middle of this valley is not sufficient for profitable fruit culture without irrigation. In the past eleven seasons it has five times exceeded 15 inches, once (1894–95) reaching 23 inches; it has four times fallen below 10 inches, once (1898–99) only 5.71. The rainfall of 1899–1900 was 9.58 inches, and that of 1900–1901, 17.74 inches. The average of the five years following 1895 was only a little over 10 inches, but the average of the past eight years has been 12.79 inches. The lowest temperature that occurred during eight years was 22° Fahr. (February, 1899), and the next lowest was 23° Fahr. (January, 1901). The highest temperature during this period was 110° Fahr. (June, 1896).

Irrigation.—Between February and June, 1898, 2,880,000 gallons of water were given to the leading classes of fruit trees, vines, and other plants. Between June, 1898, and April 1, 1899, these plants required 3,710,000 gallons, the largest amounts of which were given to the citrus fruits (670,000 gallons) and to the vineyard (640,000 gallons).

The actual rainfall of the season 1900–01 was equivalent to 1.48 acre-feet. The olive orchard received early in September, 1901, an addition of .3737 acre-feet, making a total of 1.85 + acre-feet. The apples received in August and September, 1901, .5191 acre-feet, making a total of 1.99 + acre-feet. The pears received more, bringing their total to 2.09 acre-feet. The peaches received very little, bringing their total to only 1.65 acre-feet. The oranges were watered in May, June, July, and August, 1901, making in all 2.64 acre-feet, including, as in above estimates, the season's rainfall. This is equivalent to 31.68 inches of rain.

Seeds from Washington.—By far the greater part of the valuable seeds received from the Section of Seed and Plant Introduction that were sent to the substations were tested here, both on the home tract and on the ten acres of moist land; where the alkali destroyed many.

One of the most valuable of the seeds received from Washington was the African stock-melon called Tsama, or Khama melon, a native of the South African karroo. The accompanying illustrations show comparative yields of vines of the well-known Kansas stock-melon (Plate 20) and the Tsama (Plate 21), grown on light sandy soil without irrigation. In this case the Tsama yielded a little more than nineteen tons per acre, as against ten tons produced by the former. The Tsama grew well and yielded heavily one year with 5.71 inches of annual rainfall. The melons are small and look unattractive, but are eaten by all kinds of livestock.

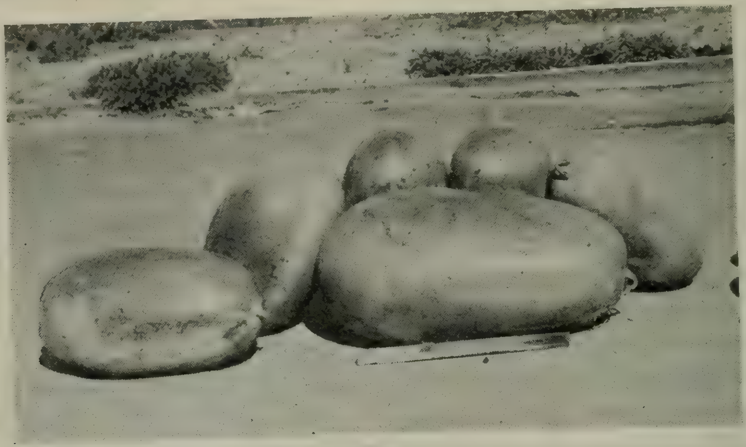

PLATE 20. KANSAS STOCK-MELON.

PLATE 21. TSAMA OR KHAMA MELON.

Among the other valuable introductions made by the Department of Agriculture, and especially suited to this district, were a collection of varieties of soy beans, a number of vegetable marrows from Italy, the large Victoria field pea, Berseem, or Egyptian clover, Turkestan alfalfa, sugar-beets, field carrots, etc. Four varieties of Egyptian cotton, planted

May 20, 1901, germinated poorly. The plants grew well, and began to set bolls late in August. A little seed ripened. The best plants were four and a half feet high. The season is rather short here, but the deep-rooting of the Egyptian cottons give them especial value.

Grapes from the U. S. Department of Agriculture.—Nos. 5909 to 5918, inclusive, sent from Washington, were cuttings of new grapes, and some of each kind were grafted upon ten-year-old vines. All varieties excepting No. 5911 grew, both grafts and in nursery. No. 5913 ripened "a bunch of grapes over a foot in length" on one graft, a dark blue, tough-skinned, prolific variety; No. 5912, a large white grape, also ripened some fruit. These grafted vines made growth of from 100 to 360 feet, counting total lengths of all branches and laterals.

The Deciduous Orchard.—After testing all the leading deciduous fruits in the greatest obtainable variety for ten years, the substation finds suitable to this locality the following number of varieties: Of apples, 15 varieties; of pears, 8 varieties; of plums, 14 varieties; of peaches, 31 varieties; of cherries, none; of apricots, 5 varieties. Prominent among the successful varieties here are the following:

Apples: Red Astrachan, White Astrachan, Early Ripe, Trenton Early, Sonoma, Shannon, Ortley, Hoover, Arkansas Black, Rhode Island Greening, Smith Cider, and Yellow Newtown Pippin.

Pears: Cole, St. Andre, Epine Dumas, Beurré Clairgeau, Duchesse d'Angouleme, P. Barry.

Plums and Prunes: Burbank, Satsuma, Wickson, Ogon, Wayland, Czar, Grand Duke, Ontario, Rivers' Early Prolific, Tragedy prune.

Peaches: Amsden's June, Early Crawford, Comet, Stump-the-World, California, Runyon's Cling, Sellers' Cling, Lovell, Foster, Muir, Henrietta.

A large collection of new peaches is not yet fully tested, and the same is true of the new American and Japanese-American plums.

All varieties of trees that have proved without value here have been removed, excepting in the case of those which can be used as stocks. The full report upon this deciduous orchard will ultimately appear in the form of a bulletin. The substation has locally distributed grafts and buds of all the varieties of fruit that thrive here, particularly of some American and Japanese plums, southern peaches, etc.

A coöperative experiment is being carried on with other stations, particularly that of Texas, on various races of peaches, such as Persian, Peen-to, South and North China, and Spanish. The value of southern types of peaches here is becoming more manifest.

The Ten-Acre Tract.—Work on the moist-land tract has continued steadily and the reclamation of the alkali portions is progressing. The water which runs from the drain-pipes is not now strongly impregnated. On the strong alkali plots here a good crop of sorghum was produced in cases where it followed volunteer barley, the ground being well shaded or cultivated the whole season; but on small trial plots planted in the spring, much alkali came to the surface and destroyed the greater part of the crop. Comparative analyses have shown that during the three dry seasons just passed, a material increase in salt content has occurred all over this tract, as well as elsewhere on the Chino ranches, by rise from below.

The young orchard on the ten-acre tract is nearing a bearing age.

Apples have done better than was expected. Pears and quinces are doing well. The location is too frosty for citrus fruits, even if there were no alkali here.

Eucalypts.—A small grove of eucalypts, including all the best species grown at the Santa Monica forestry station, has been planted east of the main station tract, to afford a shelter against winds and to test the comparative growth of the different species. It is on a light, sandy soil, and a portion of the land has been devoted to cañaigre for several years, as noted in previous reports.

THE FORESTRY SUBSTATIONS.

During the past three years, both of the tree-culture substations, at Santa Monica and at Chico, have considerably extended their plantations, principally, however, at Santa Monica, as the expenditures at Chico have been materially curtailed. There has been a large and valuable increase of the water-supply at Santa Monica, obtained by digging further under the hill from which the spring issues; and this is now all utilized.

Recent Changes in Management.—The patrons remain the same, Mr. Roy Jones, son of Senator John L. Jones of Nevada, at Santa Monica; and Mr. V. C. Richards at Chico. The vacancy made at Santa Monica by the promotion of Mr. C. A. Colmore to the clerkship at the Central station, was filled by the promotion of Mr. Wm. Shutt, first workman at the Southern California substation.

The necessity of reducing the expenses at Chico led to the discharge of the workman in 1900 and the making of an arrangement with Colonel Royce (manager of the Bidwell ranch) by which the absolutely necessary labor of cultivation was done and one of the ranch workmen occupied the house. In 1901, the necessity of setting out a large number of trees from the nursery, and of extending the eucalyptus grove, led to the appointment of Mr. T. H. Bohlender, formerly superintendent of the Chico nursery and now in charge of the orchards there, to give a portion of his time to the substation and to keep a workman there. The Chico ranch also gave Mr. Bohlender the use of a part of the greenhouses for the propagation of plants. In this arrangement, as with everything connected with the substation, Mrs. Bidwell and Colonel Royce have been most helpful.

Improvements.—The only improvements have been made at Santa Monica, where the cottage, the stable, and the water-system have received necessary repairs and additions. The amount of water now delivered at the cottage level, using both windmill and hydraulic ram, is ample for the present uses, even in years of short rainfall, and the overflow from the hydraulic ram is ample for the nursery and garden on the lower level. During the past two years, about three acres of land heavily covered with brush (*Rhus laurina* and other native growths) has been cleared and deeply cultivated, ready for the reception of trees. The bulk of this work was done in 1901.

New Tree Plantations.—During the last three years, the continuation of tree-planting at both Santa Monica and Chico, although not on a large scale, has been of especial interest because of the great number of new species represented, and the probable future value, to the State, of some among them.

At Santa Monica specimens of many new eucalypts and acacias, from twenty to fifty of a kind, have been planted on the upper mesa, and also on the middle or cottage level, where their growth has been surprisingly good; measurements showing in every case the adaptation of this class of trees to the district. These collections of acacias and eucalypts were from several sources. A large number were grown from seed sent out by the Department of Agriculture at Washington; others came from various botanic gardens by way of exchanges; some were purchased from Vilmorin and other European dealers. A number of species of trees other than the above have been added to the collection. Some of the poorest specimens of trees in the old collection otherwise sufficiently represented have been removed. In addition to specimen groups of new acacias and eucalypts, the old plantation has been considerably extended near the entrance to the grounds, on the eastern side, along the base of the hill, on land cleared in 1901.

Propagation of trees in the nursery has been steady, and large distributions of new species, particularly of the acacias and eucalypts, have been made to public institutions and to a number of persons in the southern part of California who have agreed to observe and report upon the growth. One such plantation has been begun at the Oxnard ranch, in Ventura County, another at Hueneme, and a third on land adjoining the Southern California substation in the Chino Valley.

At Chico, where the conditions are entirely different from those in Santa Monica, all the conifers in the nursery have been set out. There has also been planned an extension of the eucalypt groves, and about 3,000 trees of *E. rostrata*, *E. viminalis*, *E. obliqua*, and *E. leucoxylon* are now ready to be set out. Many species of eucalyptus are too tender for a large part of the Sacramento Valley, and large trees of *E. globulus* have been killed to the ground at Chico. The desirability of establishing groves of the hardier and more valuable timber species of eucalyptus is therefore evident.

Distribution of trees from the nursery at the Chico substation to public institutions continued until 1901, when all the remaining trees were set out. Distributions of cuttings have been made every season. The large willow collection, spoken of in previous reports, has been much in demand. A shipment of cuttings from this willow collection went to the Conservator of Forests in South Africa this year; another collection was sent to the Philippines, a third to Mexico, and a fourth to British Columbia. All arrived in first-rate condition.

Hardwood Trees.—The growth of the English oaks has been much better at Chico than anywhere on the coast. They make tall and healthy trees. Nearly all the oaks tested there have done well except the Japanese species, but the English, the cork, and some of the east-American species have done extremely well. The small wasp (a species of *Andricus*), which near the coast bores into the oak branches, making knots, checking growth, and weakening the tree, has not yet been observed on the oaks at Chico. Hence they are not dwarfed and shrubby as in many other places in California.

Ashes (*Fraxinus*) of all the leading species grow extremely fast at Chico, and promise to become valuable timber trees. *Eucalyptus rostrata* seems especially well adapted to the district.

Seed Collections.—The entire seed crop of the new and rare trees coming into bearing at both forestry stations is gathered each season and distributed either locally or through the Central station. Each year something new comes into bearing. In 1901 it was the handsome, large-leaved Brazilian pepper-tree (*Schinus terebinthifolius*).

TREE EXPERIMENTS IN THE SAN JOAQUIN VALLEY.

From time to time large shipments of trees have been made from Santa Monica and Chico to institutions and individuals who report upon results. One such shipment, made about five years ago to the San Francisco & San Joaquin Valley Railroad, has been reported upon by Mr. Johannes Reimers, the head gardener on that portion of the Santa Fé line, and the following brief notes are condensed from his letter:

At Escalon, among the maples, *Acer pseudo-platanus*, the "sycamore maple," grew better than either *A. dasycarpum* or *A. rubrum*. The ashes (*Fraxinus*) grew but slowly. *Biota orientalis* succeeded. The Ginkgo tree (*Salisburia adiantifolia*) suffers from the dryness of the atmosphere. Cork elms grew very well indeed, but pepper-trees (*Schinus molle*) were frosted and took some time to recover.

At Elmwood, also on sandy soil, but better than at Escalon, all the trees made larger growth. *Fraxinus excelsior* was the best ash. *Acacia trinervis* and *A. leucophylla* started slowly, but did well in the end. The Oriental sycamore, *Platanus orientalis*, was one of the best trees tested. Among smaller trees and shrubs, *Cladrastis tinctoria*, several coluteas and genistas, *Leicesteria elegans*, and *Maytenus boaria* were most successful. Here, and at Ballico and Cressy, the sycamore maple (*Acer pseudo-platanus*) made rapid growth.

The soil at Geneva is a dark, reddish clay and hard to cultivate. One of the most satisfactory trees here was *Cratægus oxyacantha*, the common English hawthorn. *Acacia decurrens* was excellent. Chestnuts also did very well indeed. *Ficus elastica* and pepper-trees were killed to the ground by frost.

Sharon is on "hog-wallow" soil—a sandy clay underlaid with hardpan. Here Mr. Reimers had the hardpan thoroughly broken up, and large holes dug and filled with good soil. The resultant growth of the trees surpassed that at any other station on the line. The sycamore maple and the European sycamore made especially rapid growth. At Lankershim station, also on "hog-wallow" land, but deeper to hardpan, *Acer dasycarpum* and *A. rubrum* did better than elsewhere along the road. The salisburias did poorly. Here, as nearly everywhere else, *Pinus sabiniana* barely kept alive.

Oleander is on dark sandy and alkali soil. The chestnuts died here; the cork elms did poorly; *Salix salmoni* grew quite well, and so did the common white mulberry and the American persimmon.

At Conejo station the sandy soil is still more alkaline than at Oleander, and two willows, *Salix salmoni* and *S. regalis*, were all the trees that lived and grew there.

Cutler station is on "hog-wallow" land, further complicated by alkali and hardpan close to the surface. The sycamore maple was the best tree tested here.

Atla station, close to the Sierra foothills, is on a deep, rich, sandy clay, well adapted to tree growth. The American elm, American ash, and all the maples throve here. There was little frost, and pepper-trees grew well; also acacias, mulberries, chestnuts, and many other species.

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REPORT OF WORK

OF THE

AGRICULTURAL EXPERIMENT STATION

OF THE

UNIVERSITY OF CALIFORNIA

FOR THE YEARS 1898-1901.

PART II.

BEING A PART OF THE REPORT OF THE REGENTS OF THE UNIVERSITY.

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INTRODUCTORY NOTE.

July 25, 1902.

President Benjamin Ide Wheeler,
University of California,
Berkeley, Calif.

Dear Sir: Supplementary to the statements made regarding the experimental work in my communication to you, introductory to Part I of this report, I must add a brief discussion of the instructional conditions in the College of Agriculture, which I thought might be better discussed by the light of later events.

In common with the other departments of the University, the classes in the lecture rooms of the College of Agriculture have increased greatly within the last few years. Where, in past years, twelve or fifteen students occupied seats, from forty to fifty now usually attend; being quite as many as ordinarily should form a single class. Unfortunately, the College of Agriculture is not, in the publications of the University, given credit for this attendance; so that the public remains under the impression that a dozen or two students, registered in the regular courses, form all the attendance that we have. As a matter of fact, for several years past the actual attendance has been about two hundred, including special students and others attending various courses. Besides these, forty students attended the Dairy School. In view of the erroneous impressions thus formed by the public interested, both in and out of this State, I suggest that a special statement showing the true state of things might be in place.

When we analyze the attendance of *bona fide* agricultural students—meaning thereby those who intend to follow agriculture as a professional or life occupation—in other colleges of University grade, few make a much better showing than we can; even in the Old World, where the bulk of students (e. g. in the agricultural college of Prussia) belongs to the classes of foresters, surveyors, and "Cameralists." The latter, it is true, have a direct connection with agricultural pursuits, inasmuch as they are employed in administration of Government "domains"; but only a fraction are themselves landowners and farmers. It can not be expected that this state of things will change quickly, anywhere; there must first be a distinct career in sight for students who qualify themselves in the higher walks of agricultural science. Nevertheless, there is right at this time a marked dearth of well-qualified graduates of agricultural colleges, the demand for practical agriculturists especially far exceeding the supply. What with positions in the rapidly expanding Agricultural Department at Washington, and those that are constantly being vacated in the State Colleges and Experiment Stations because of imperfect qualifications of the incumbents, or from other causes, there is certainly at present more room in the line of agricultural experts than in the crowded professions of law and medicine. In view of these facts it is certainly remarkable that so few of our young men elect to take the regular agricultural course, which would qualify them for these positions.

Meanwhile, the truth of the view I have long maintained, viz., that practical farmers must as a rule be educated in special schools scattered over the land and corresponding to the farm schools of Europe, or to the high schools of the United States, is becoming more and more appreciated and acted upon. Wisconsin has taken a strong lead in the establishment of county agricultural schools. We have a hopeful beginning in the technological school just established near San Luis Obispo; many more such must, in the course of time, be established in obedience to the public demand. Ultimately the teaching of the rudiments of the sciences bearing upon agriculture must form part of the regular school course in the rural districts, and the idea that the boy in the city and the boy in the country must have identically the same training must be seriously modified.

There is at present, however, an absolute dearth of teachers qualified to do such work; and it is clearly the function of the University to give the required training, through the College of Agriculture.

But to supply this demand, by giving such instruction to classes as large as those now occupying our lecture rooms, requires appliances wholly different from those which have heretofore been adequate. It is impossible to call, individually, classes of forty or fifty to the microscopes or polarization apparatus; it is now necessary to project such objects upon screens by the magic lantern, or to have them represented in diagrams drawn upon a large scale, or by models. In all of these respects our equipment is wholly inadequate; nor do the funds allowed us during the coming session permit of any material increase in these needful means of demonstration. The Agricultural Department is in this respect far behind every scientific department in the University, including even that of Botany, the most lately established. So much so that as matters now stand, this inadequacy reflects seriously upon the efficiency of the work even in the lecture room, and still more in the several laboratories. These, since the fire of 1897, have been living from hand to mouth, the equipment then lost, inadequate as it was, having never been fully replaced; while at the same time the allowance for current expenses is still on the same basis as during the period of extreme financial distress which preceded the present more bountiful dispensation for the University at large, and when students were only one third their present numbers.

The results derived from a well-equipped laboratory are well illustrated in the case of the Dairy School, which last year had a very fair equipment, a large part of which unfortunately was only borrowed and may not again be available. But the course was so satisfactory to the forty students attending it that its repetition with an increased allowance of time was strenuously urged, and we may expect that course to be as well filled at least during the coming season. But if the proper appliances for actual practical work shall not be available, there will be severe disappointment, and naturally following it, a discrediting of that department, and of the college at large.

One of the needs that has become pressingly apparent since the departure of Mr. Bioletti, is the appointment of a plant pathologist, to teach that subject in the course, and to prosecute investigations which are among the most frequently called for, and with which we have not at present any one competent to deal. The profound differences in climatic conditions between California and the East render it necessary that the person employed should be capable of independent investigation, not merely of following the trodden paths.

Owing to the absence of the Assistant Botanist (Mr. Jos. Burtt Davy) in the field at the time of going to press, no report of his work could be included in the discussion of the Station work introductory to Part I of this Report. The following summary of work done during the past two years, which will be reported upon in detail hereafter, has now been supplied by him:

During the past two years the time of the Assistant Botanist has been devoted to the following lines of work:

1. Investigations upon the grasses and forage plants, and the range conditions in the following regions: Northwestern counties of Mendocino, Humboldt, Del Norte, and Lake—(a report on these has just been issued as Bulletin 12 of the Bureau of Plant Industry, U. S. Department of Agriculture); Point Reyes; and the Santa Lucia mountains in Monterey and San Luis Obispo counties.

2. Investigations and experiments in reclaiming drift-sands along the coast, in coöperation with the Bureau of Plant Industry, U. S. Department of Agriculture. Almost the whole coast-line from Smith River, Del Norte County, to Redondo, Los Angeles County, has been examined. Reclamation work is also being carried on at Lake Earle, Samoa, Point Sur, and Hueneme.

3. Investigations and experiments in the cultivation of leguminous plants for green-manuring in orchards.

4. Investigation and correspondence connected with the introduction of new cultural plants.

5. The collection and preparation of seeds for the seed collection of the department, necessary for instruction.

6. The collection and naming of the cultivated plants of the State, and their preparation for the herbarium.

7. Identification of plants sent in by parties throughout the State; and that of plants grown at the Station from seeds sent under wrong names.

8. Correspondence and interviews upon topics above given occupy much time, about four hundred letters being written each year.

Respectfully submitted.

E. W. HILGARD.

SOILS.

IRRIGATION, CULTIVATION, AND HARDPAN.

By E. W. HILGARD.

The difficulty of the average man in breaking loose from old traditions is forcibly illustrated in some of the cultural practices which, despite sad local experience, are still perpetuated in California, for the reason that our forefathers in Europe and in the eastern United States have found them good; regardless of the fact that circumstances alter cases, and that the prescriptions which have held good for centuries in the old country may be wholly out of place here in the arid region, or may need to be materially modified in their application.

While it is true that the most ancient civilizations of the world have existed in arid countries, it is also true that the modern development of science and art has taken place almost wholly in the humid countries of Europe and America. Now, while the principles of both science and art must be the same everywhere, the *application* of the sciences bearing on agriculture to its practice must of necessity vary with differences of climate and soil, very much as does the natural vegetation. We shall vainly try to make the skunk-cabbage and may-apple of the East grow in California, no matter how much water we may supply them; and vice versa, the cactus and gray sage of the arid region will fail to thrive in the regions of forty to sixty inches of rainfall, unless artificially supplied with the conditions prevailing in their native home, not merely as to moisture, but also in respect to soil and air.

Our Eastern friends commiserate us on account of our being obliged to irrigate; and when they come here to live and farm their only idea is that as irrigation replaces rain, so soon as that is attended to the rest may be done just as it is in the Atlantic States. That this frequently proves a very costly delusion, need not be explained to Californians. But it seems necessary to call their attention more pointedly to some of the points too frequently ignored or neglected, wherein our practice should and must materially differ from the Eastern, which unfortunately is still intuitively regarded, especially in the East, as the normal thing to be done everywhere, simply because the forefathers have "proved" it to be the right thing in their home. And I must admit that not only the farmers, but even the men of science have fallen into this rut, and will hardly believe that the natural conditions with us are so different from their " normal " ones, as to necessitate serious differences in practice. The indulgent smiles I have so often seen in the countenances of my scientific brethren in the East and in Europe, when insisting on these points, usually express the idea of a "California yarn," forgiven because of the influence of the climate upon the imaginations of those who dwell therein.

The most important differences in our farming practice as compared with the East, arise from the fact that, unlike the lands of the regions of summer rains, ours have in most cases practically nothing that properly corresponds to the "subsoil" of the Atlantic States. The Eastern subsoil differs from its surface soil in that almost always it is more dense or clayey than the surface soil; is practically destitute of humus or vegetable mold; and is "raw," that is, unfit to serve for vegetable nutrition to any such degree as to serve for crop growth if it were on the surface. Hence, if in subsoil plowing it were turned up to any considerable extent, it would ordinarily mean the failure of at least one succeeding crop.

The formation of this clay subsoil is due primarily to the moist summer air and heavy rainfall. The former, as is well known, favors the formation of clay; heavy rains then form turbid clay water, which in soaking down is detained in the subsoil long enough to deposit most of its clay, and thus continually increases its heaviness. Hence we usually find, in the East, the surface soils very much "lighter" than their subsoils.

But the same is not true of the bulk of our California soils. In by far the majority of cases, there is no sensible difference as to clayeyness between the surface soils and that immediately underlying the subsoil mass, often to depths of five and even ten feet. Clay forms very slowly in dry climates, and there are no beating rains to wash it into the subsoil. Hence the latter remains porous, and both water and air penetrate freely and easily to great depths; and hence, again, the roots, which like the rest of the plant require the presence of both, also penetrate and exercise their vegetative functions at these depths, in the absorption not only of water but also of nourishment. For in consequence of the penetration of air, the substrata are not "raw" as in the East, but contain available plant-food throughout their mass; and normal humus, derived from the decay of the roots, is present to the depth of several feet. Instead, therefore, of being compelled to draw their nourishment from six to nine inches of surface soil, our trees can naturally feed upon five to ten feet of soil mass in our valley lands. Add to this advantage those of a natural supply of most kinds of plant-food several times greater than in the average Eastern soil, and it certainly seems strange that the cry for fertilizers should be so early raised in the face of such natural advantages.

But the strangeness disappears when we examine the methods of both cultivation and irrigation now so commonly in vogue. By plowing to the same depth year after year, and irrigating frequently in shallow furrows, we produce artificially the very conditions which in the East produce the close subsoils, difficult to penetrate by air, water, and roots. In the East, the impediment thus artificially created is called a *plowsole;* in California a new name has been invented for one form of it, viz: "Irrigation Hardpan"; and much ingenious speculation has been indulged in as to the cause, supposed to be a chemical change in the soil.

In none of the cases that have come under my observation can there be any question as to the real origin of this trouble. Under the influence of the Eastern tradition, our farmers have been afraid to plow to more than the Eastern allowance of soil depth, uniformly, year after year; with irrigation furrows to the same depth, or less, and a tendency to irrigate as frequently as possible, in imitation of Eastern rains. One need only glance at the turbid water often seen in these furrows, and at the shining streaks behind the plow soon afterward, to understand that, in lands at all clayey, a solid plowsole will form here as in the East; the more, as few persons ever undertake to ascertain by actual examination how deep the irrigation water has penetrated during the time allowed by the zanjero. No wonder that, when a large part of the water runs off above the plowsole, despite the irrigation the deeper roots are often found to be in dry earth, and white-spotted leaves and "die-back" afflict the trees; while the soil above the "irrigation hardpan" is filled with white roots that should be active in the depths of the land, but within their limited range must needs be fed with fertilizers to take the place of the abundant supply that lies in the substrata, but is rendered unavailable by the plowsole.

There is, of course, no remedy for this evil except to break up the plowsole, gradually if time permits, white roots and all; and to prevent the recurrence, the land must, as should always be done, be plowed to different depths every alternate year. In doing this we need not hesitate, in nine cases out of ten in this State, to put in the plow to the full depth to which the team can pull it. And in order to avoid the excessive root-pruning that might thus be brought about, it is only necessary to put the irrigation water itself where it will do the most good; to wit, in *deep* furrows, from which it will soak down rapidly to wet the substrata, leaving the surface only moderately moist by soakage from below ("capillary ascent"), and causing the roots to descend into and utilize the entire soil mass, as do our native plants, instead of a paltry surface layer of twelve or fifteen inches only.

To put the matter plainly, the question is whether we shall aim to utilize the soil mainly in a horizontal direction only, or chiefly downward, or both. The former alternative is the one adopted by most of our irrigators at the present time, by the practice of shallow cultivation and equally shallow furrow-irrigation; the second was the choice of those who in early times practiced the original method of basin irrigation, in which the water was applied in circular basins, or rather trenches, dug around the trees—a wholly different procedure from what has wrongly been so called of late, viz., the application of water in basins formed by throwing up a square levee around the trees and flooding the surface, as well as the base of the trees. This is a kind of check irrigation, misapplied, where it will do the most harm by compacting the surface where it can not afterward be cultivated except by hand, and chilling the trunk and main roots so as sometimes to cause the dropping of fruit.

Considering the frequent scantiness of the water-supply, especially in southern California, I think there can be no question as to the advisability of, in the first place, utilizing the water to the best advantage, and secondly, preventing the tree roots from remaining close to the surface in white masses, like the corn roots in Eastern cornfields; when if water should not be available promptly during a hot spell, serious injury may quickly result. No such stress would arise if, in imitation of our native plants, the feeding roots were at such a depth below the surface that the heat and drought could not reach them within any brief delay in irrigation; in some localities they would not suffer materially *without* irrigation if their roots had been taught from the outset to descend into the moist depths of thoroughly winter-irrigated land.

Whether or not they shall do this depends entirely upon the treatment of the trees while young. If, in order to push their growth and bring them quickly into bearing, the orchardist starts in by manuring and irrigating them abundantly and frequently, in accordance with Eastern ideas, his trees will make Eastern, shallow roots; having no inducement to seek the depths of the soil. Such a root-system being once formed, the practice which brought them about must naturally be continued, with a wholly unnecessary, extravagant expenditure for both fertilizers and frequent irrigation. For what shall it profit a tree to have had the land thoroughly soaked in winter, whether from rains or irrigation, if it has no roots sufficiently deep to utilize that stored moisture?

It seems to me that the advantage of a year's earlier bearing of an orange grove is very dearly paid for by such lifelong dependence on fertilization and punctual irrigation as we so commonly see now.

It is true that this condition is not irremediable, but has to be paid for by subsequent probable losses of crop resulting from the pruning-off of the superficial roots, that must be done in order to aid the formation of a deep-root system. I say probable losses, because I have known cases in which no such loss followed the courageous adoption of a rational system of deep cultivation, and irrigation in deep furrows, few in number, from which the water soaks chiefly downward, where it is wanted, to store moisture out of reach of evaporation, and to cause the root to follow its lead.

But if an artificially formed hardpan or plowsole is bad, a natural one is worse, because usually it is of such thickness that it can not be destroyed by any practically feasible means. Sometimes, in the case of orchards, it is feasible to shatter it by means of dynamite charges in the tree-holes, and this has served to relieve the situation in many localities in this State where otherwise no orchards would have been possible. But this possible remedy is expensive and sometimes fails to afford permanent relief, because certain kinds of hardpan with copious irrigation relapse into their original condition. At present at least, the lands so constituted naturally had better be used for annual crops only.

Few persons outside of the Experiment Station can have an idea of the extent to which the planting of orchards on shallow soils underlaid by hardpan or heavy clays has caused pecuniary loss, often almost ruin, to old-timers as well as to new-comers to the State. Every few days there come to us at Berkeley letters transmitting samples of tree-branches having the "die-back," and asking about the means of relief. We might usefully stereotype the first letter in reply to such inquiries, briefly to the effect: "Examine your subsoil!" In nine cases out of ten, it is either hardpan, or an impervious clay substratum, which deflects the roots sideways after the second or third year, and of course prevents a healthy, normal development toward the moist depths of the soil, where abundant plant-food awaits them in all good orchard lands. More rarely it is a layer of coarse sand, or gravel, which prevents the rise of moisture from below; sometimes it is the rise of the bottom water, which causes disease of the deeper roots, and also starves the tree. Almost invariably the question is asked: "What fertilizer must I apply to remedy the trouble?" Well, in most cases no fertilizer of any kind will remedy the difficulty; the existence of which should have been ascertained before planting the orchard, or better, before buying the land at all. Even in the East and in Europe, careful farmers scrutinize the subsoil before investing. In the arid region this is tenfold more needful, because of the critical importance of the subsoil, overshadowing that of the surface soil, as already explained. The irrigator who pays so dearly for his water is doubly interested in it, and ought always to know how long it takes water to soak to a certain depth in his land, so as to be sure that it does not run off the surface of natural or artificial hardpan, and flow to the neighbor below, instead of soaking down.

This seems to be such elementary common sense that it is difficult to understand how it is so widely neglected, despite the warnings so emphatically conveyed by experience, and published by the Experiment Station for twenty years past. No farmer should be without that simple and cheap, though murderous-looking implement, the soil prod, which is so readily used. It is a steel rod three-sixteenths to one-fourth inch square, well pointed at one end, and provided at the other with a stout ring for a wooden cross-handle, like a common auger. Length from four to five feet, preferably the latter; cost, seventy-five cents. This is forced into the ground with a slight turning motion back and forth, hanging to it at first if one is of low stature. The farmer will be surprised at the new information conveyed by this simple process within the two or three minutes it takes to make one sounding; and if any doubt remains at some point, the common posthole auger may be made to supplement the prod. But with a little experience, the prod alone will suffice to tell the farmer, by the change in resistance, even how deep the irrigation water has penetrated in his land. And in many cases such information will astound him by its unexpectedness and make him understand why certain trees in his orchard have done so poorly, or so well.

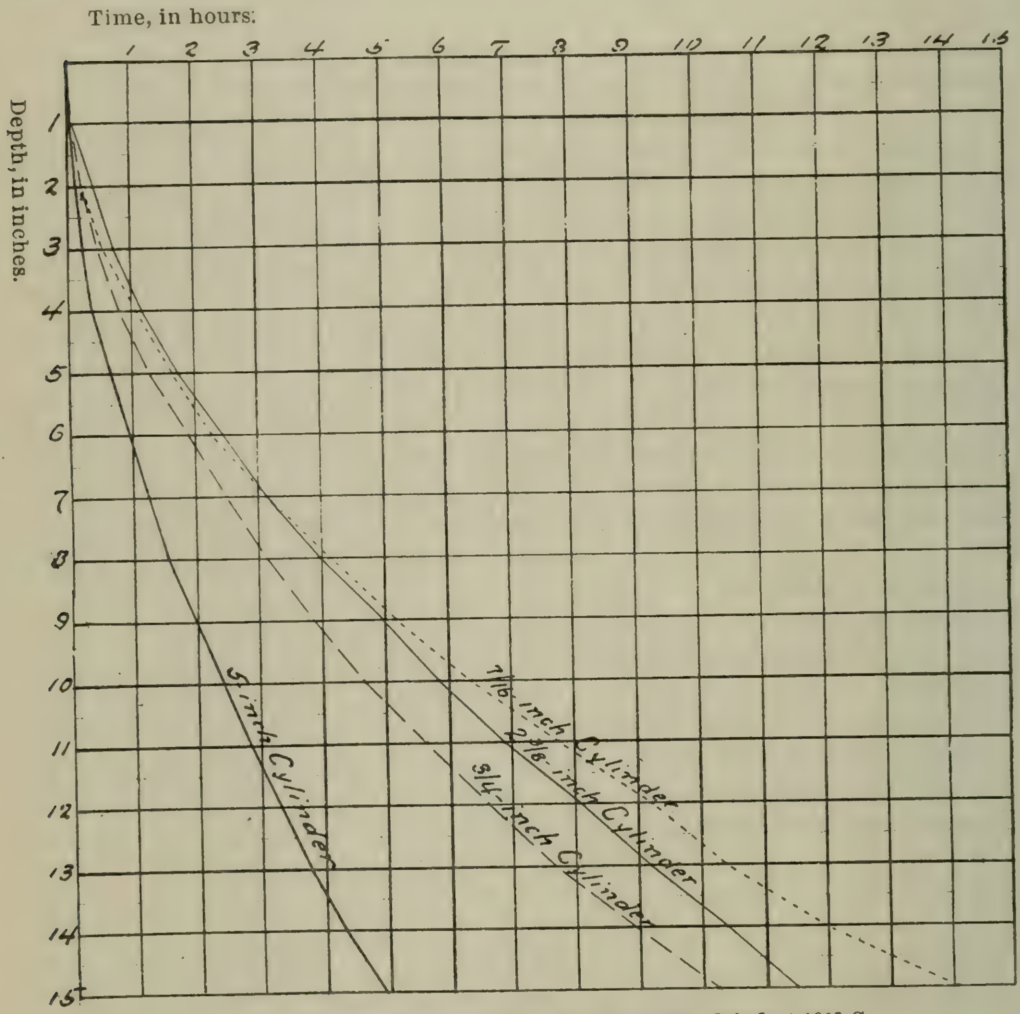
However important is the presence of the plant-food ingredients in the soil, the fundamentally needful point is the *proper physical condition*, without which no amount of fertilization, or natural productiveness, is of any avail. All understand the need of moisture; but unless care is taken to see that it gets where it will do the most good, and that the roots can perform their functions in the depths of the soil, water, work, and fertilizers may alike be wasted.

A LABORATORY STUDY OF THE PERCOLATION OF WATER THROUGH SOILS.

By A. V. STUBENRAUCH.

Introductory Remarks.—In a State like California, where irrigation is so prominent a factor in crop production, the rapidity with which different soils can be wetted with water becomes not only a question of great interest to the investigator, but also one of prime importance to the farmer. Not only is it essential that a sufficient quantity of water be supplied, but the time necessary for this water to reach the depths of the soil, where it is needed, should be known and taken into account in irrigation operations. To gain some idea of the element of time in the case of different soils, the investigations here discussed were undertaken. It must be understood, however, that these experiments can be considered only as preliminary to a more thorough and exhaustive study of the questions in the field under natural conditions. It is undoubtedly best to gain first some knowledge of the subject under known and controllable conditions, and thus secure data which may possibly serve as a basis, or at least a guide, in undertaking future field operations.

Difficulty of Producing Concordant Results.—In order to produce conditions which will yield comparable results with different soils, it becomes necessary first to ascertain what conditions will enable duplicate results to be obtained with the same soil. Until this can be done, the conditions which bring about differences are not known or under control, and the comparison of different soils can not be made with any degree of certainty or fairness.



IG. I. Divergent rates of flow through soils dried at 100° C.

The percolation experiments herein cited were conducted in the usual way; i. e., in glass cylinders filled with the soils (air-dried) under investigation, the rate of flow being easily obtained by measuring the progressive wetting of the soil. It has always been the writer's firm conviction that no definitely known conditions can be secured by the usual practice of simply pouring the soil into the cylinders and then tapping the latter until the soil particles ceased to settle. It has also been contended that the diameter of the tubes used materially affects the results. To prove these two contentions, four tubes of different diameters—5 inches, $2\frac{3}{8}$ inches, $\frac{3}{4}$ inch, and $\frac{7}{16}$ inch—were used, and filled with soil in the usual way; i. e., tapping gently until the mass ceased to settle. In order to make the results as uniform as possible, the same soil was used in all cases. First the 5-inch cylinder was filled, and, after water had run through this, the soil was dried on a steam bath (100° C.) and used in the other tubes, after being crushed with a rubber pestle. In all cases distilled water was used and maintained at a depth of one half inch on top of the soil columns. The 5-inch and $2\frac{3}{8}$-inch cylinders were closed at the bottom, and were, therefore, provided with small air-vent-tubes. The widely divergent results of these experiments are shown in the following table and the accompanying curve diagram:

TABLE I. SHOWING DIVERGENT RATES OF FLOW IN CYLINDERS OF DIFFERENT DIAMETERS, WHEN SOIL DRIED AT 100° C. WAS USED AND FILLED BY THE USUAL METHOD OF POURING AND TAPPING.

Depth, in Inches.	5-inch Cylinder.	$2\frac{3}{8}$-inch Cylinder.	$\frac{3}{4}$-inch Cylinder.	$\frac{7}{16}$-inch Cylinder.
1	2 min	5 min	4 min	3 min
2	5	14	10	12
3	8	18	15	18
4	9	28	19	32
5	17	34	28	33
6	17	44	38	39
7	19	40	35	50
8	18	51	38	1 hr 1
9	27	59	45	1 2
10	25	54	47	1 12
11	25	1 hr 3	58	1 23
12	29	1 10	59	1 30
13	29	1 8	1 hr 5	1 39
14	31	1 11	1 14	1 34
15	35	1 11	1 20	1 40
Totals	4 hrs 56 min	11 hrs 30 min	10 hrs 15 min	14 hrs 4 min

If the conditions existing in the different tubes are examined, it will be found that something more than their diameters will have to be taken into consideration. Thus, the soil contained in the 5-inch cylinder was in its natural condition, while that in the others—although it was the identical soil—was dried at 100° C. Besides, the compactness of the soil—quantity per unit volume—in the different tubes was unknown and may have caused some of the differences noted. Then again, the 5-inch and $2\frac{3}{8}$-inch cylinders were both closed at the bottom and were provided with small air-vent-tubes, while the other two were provided with cloth-bottom ends to allow the escape of air. It is obviously necessary, then, to eliminate all unfavorable conditions, except the diameters of the cylinders; and in no other way can it be proved that the diameters of the cylinders used affect the results. In the case of the two larger cylinders, 5-inch and $2\frac{3}{8}$-inch, it seems highly improbable that the difference in size would cause the wide difference in the time of percolation noted; viz., nearly seven hours.

In order to determine if the vent-tubes caused any difference, the 2⅜-inch cylinder was provided with a cloth bottom, filled with a like quantity of the same soil as used before (dried once on water-bath), and water allowed to percolate in the same way. The table and curves show the result as compared with the first case:

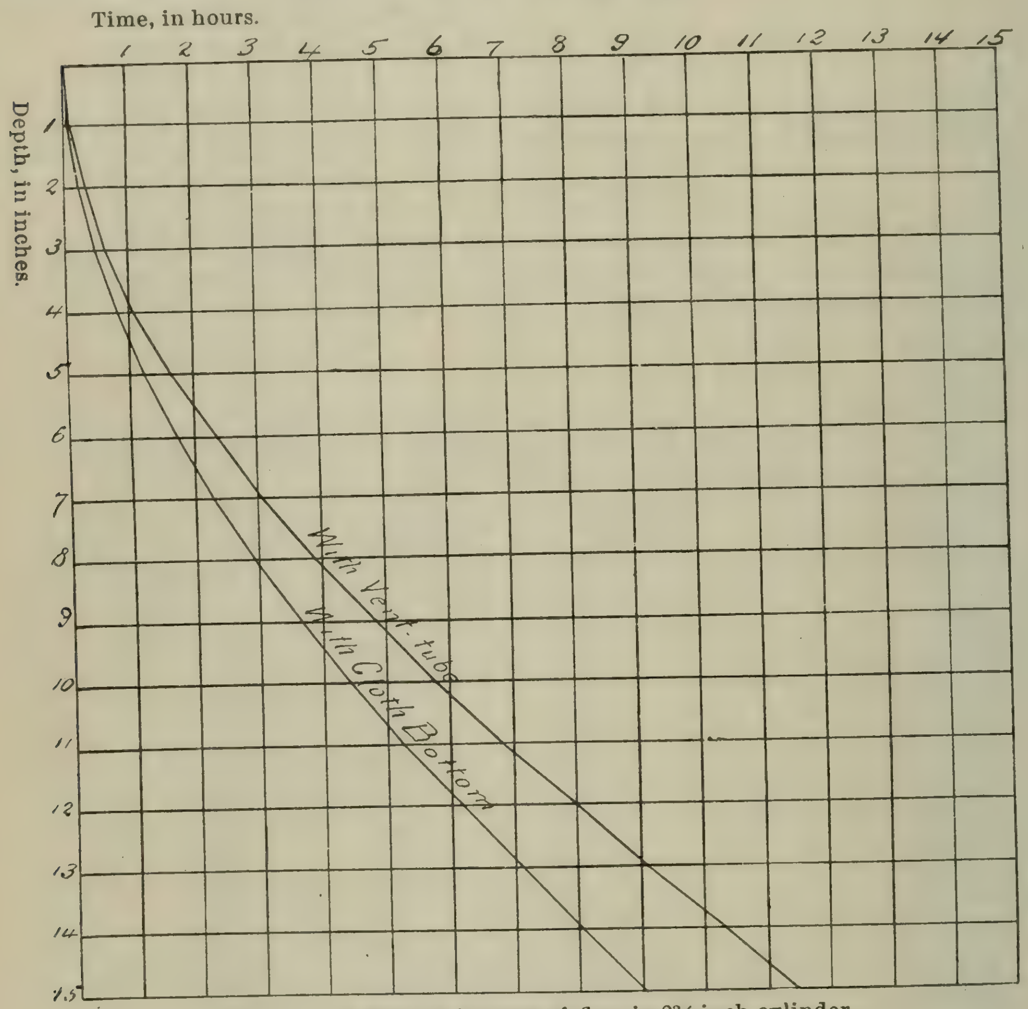


FIG. II. Difference in rates of flow in 2⅜-inch cylinder.

TABLE II. SHOWING THE COMPARISON OF THE RATE OF FLOW IN 2⅜-INCH CYLINDER WITH VENT-TUBE AND WITH CLOTH-BOTTOM, THE SAME SOIL BEING USED IN BOTH CASES.

Depth, in Inches.	With Vent-Tube.	With Cloth-Bottom.
1	5 min	3 min
2	14	10
3	18	16
4	28	20
5	34	25
6	44	30
7	40	34
8	51	37
9	59	46
10	54	44
11	1 hr 3	48
12	1 10	58
13	1 8	56
14	1 11	57
15	1 11	58
Totals	11 hrs 30 min	9 hrs 2 min

It will be seen that the flow in the cylinder with cloth bottom was two hours faster than in that with the vent-tube. As the same soil and in the same quantity was used in both cases, it is reasonable to presume that the vent-tube did actually interfere with the escape of the air, and, therefore, caused, partly at least, the slower rate of flow.

In order to bring all the tubes into fair comparison, any effect the vent-tubes might have was eliminated by placing a perforated false bottom in the 5-inch cylinder and running the vent-tube below it, thus making the condition practically the same as with a cloth bottom. The 5-inch cylinder was now filled with the same soil, but dried a second time at 100° C. The resulting rate of percolation was most surprising, there being a difference of sixteen hours between this and the raw soil used in the first experiment. Evidently the drying at a high temperature affected the conditions of the soil in some way, making its condition for wetting very different from that which exists under natural conditions. The number of times the drying was done also affected the results; more dryings gave wider differences. Thus, the difference between the rate of flow in the $\frac{3}{4}$-inch cylinder to a depth of fourteen inches with soil dried once and twice respectively was very nearly six hours.

It was next attempted to reproduce natural conditions. The same soil was wetted thoroughly and allowed to dry normally, and when in the proper state of dryness was well "cultivated" with the fingers to imitate as closely as possible the conditions existing in the field. With this normally dried soil in the 5-inch cylinder the rate of flow was very much diminished, being fourteen and a half hours less than when dried twice on the steam bath, and only one hour and a quarter slower than the "raw," or natural, soil. It was thought, then, that another normal drying and "cultivation" would bring it back to its normal state. But this proved not to be the case, for, after a second treatment of this kind, the rate of flow was much slower, being three hours and a half slower than with one normal treatment, and four and three quarters hours slower than the natural soil. Table III and Fig. III (pages 158 and 159) show the details of these several experiments.

Evidently, then, it is impossible to use the same soil more than once if comparable results are desired. The wettings and dryings under these artificial conditions obviously induce changes in the soil which alter its behavior with water. Possibly the change is due to fermentative action, causing a deflocculation of the clay, or the heating to a high temperature may act on the clay directly. Just what change takes place it would be difficult to say. The fermentation idea seems the most probable, for the soil had a distinctly peculiar earthy, or half-way foul, odor on being wetted with distilled water, after it had been used several times, that was not noticed when the fresh soil was wetted. For this reason, the plan of using the same soil over and over again was discarded, and a new set of experiments with fresh soil was started. Soil from the same place, the Pomona substation home tract, was selected, the coarse material sifted from a large quantity, enough for all the experiments, the entire mass being well mixed in order to secure uniformity. The cylinders were graduated, the 5-inch into 1000 c.c., the $2\frac{3}{8}$-inch into 500 c.c., the $\frac{3}{4}$-inch and $\frac{7}{16}$-inch into 10 c.c. divisions, and the soil filled into these at 1.75 grams per c.c. In this way it was hoped that a uniform mass throughout the column would be secured, thus eliminating all differences in the cylinders except their diameters.

The first results were more hopeful of uniformity, the rate in the 5-inch and 2$\frac{3}{8}$-inch cylinders being within an hour of each other, and the $\frac{7}{16}$-inch a few minutes faster than the 5-inch and a trifle over one hour faster than the 2$\frac{3}{8}$-inch; but the $\frac{3}{4}$-inch was altogether "out of range." These results, however, showed no reason to attribute the differences to the diameters of the cylinders. For if difference in the diameters was the cause, it is reasonable to presume that if the 2$\frac{3}{8}$-inch and $\frac{3}{4}$-inch were slower than the 5-inch, the $\frac{7}{16}$-inch should be still slower. But, on the contrary, the $\frac{7}{16}$-inch was fastest of all. It was, therefore, evident that some other cause must be found.

TABLE III. SHOWING THE COMPARISON OF RATES OF FLOW THROUGH THE SAME SOIL AFTER BEING DRIED UNDER DIFFERENT CONDITIONS.

Depth, in inches.	5-INCH CYLINDER.				¾-INCH CYLINDER.	
	Natural.	Dried Twice at 100° C.	Dried Once Normally.	Dried Twice Normally.	Dried Once at 100° C.	Dried Twice at 100° C.
1	2^{min}	6^{min}	2^{min}	2^{min}	4^{min}	5^{min}
2	5	17	5	8	10	10
3	8	34	9	12	15	26
4	9	43	12	17	19	34
5	17	54	16	24	28	45
6	17	1^{hr} 7	17	28	38	54
7	19	1 17	18	31	35	1^{hr} 0
8	18	1 30	27	40	38	1 10
9	27	1 39	31	45	45	1 15
10	25	1 52	38	47	47	1 29
11	25	2 6	36	51	58	1 47
12	29	2 3	36	57	59	1 47
13	29	2 6	42	1^{hr} 2	1^{hr} 9	1 54
14	31	2 00	44	1 13	1 10	1 54
15	35	2 42	44	1 26	1 20	2 00
Total time	4^{hrs} 56^{min}	20^{hrs} 56^{min}	6^{hrs} 17^{min}	9^{hrs} 43^{min}	10^{hrs} 15^{min}	16^{hrs} 52^{min}

Now, the surface of the soil in this set of experiments was tamped down evenly, so as to make it level and smooth, as well as to bring the last portion of the soil, put into the tube, down to the mark. It occurred to the writer that possibly this tamping might not have been done to the same extent in each cylinder; possibly the $\frac{3}{4}$-inch tube was firmed more than the others. In order to test this, another trial was made with the 5-inch, 2$\frac{3}{8}$-inch, and $\frac{3}{4}$-inch cylinders, as before, the tamping being done as uniformly as possible. In the 5-inch cylinder the results were nearly the same, there being a little divergence between the eighth and tenth inches, but at the thirteen-inch mark they were very nearly identical. With the 2$\frac{3}{8}$-inch cylinder the results were not so nearly duplicated, there being a difference of nearly an hour at the thirteen-inch mark, while between the first and ninth inches the rate of flow was faster in the second trial. It became slower than the first trial after that point was passed. In the $\frac{3}{4}$-inch tube the rate was nearly an hour and a half slower than in the first trial, making the difference still greater between it and the other three. This was too much to condone. The re-calibration of the cylinder was attempted, but during the operation it was broken. A new one was prepared; this time the calibration being duplicated. The new tube was carefully filled, as before, and a third trial made. This time the rate of flow was very materially diminished, being within four minutes of that in the $\frac{7}{16}$-inch tube, and thus bringing the results well within the limits of comparison.

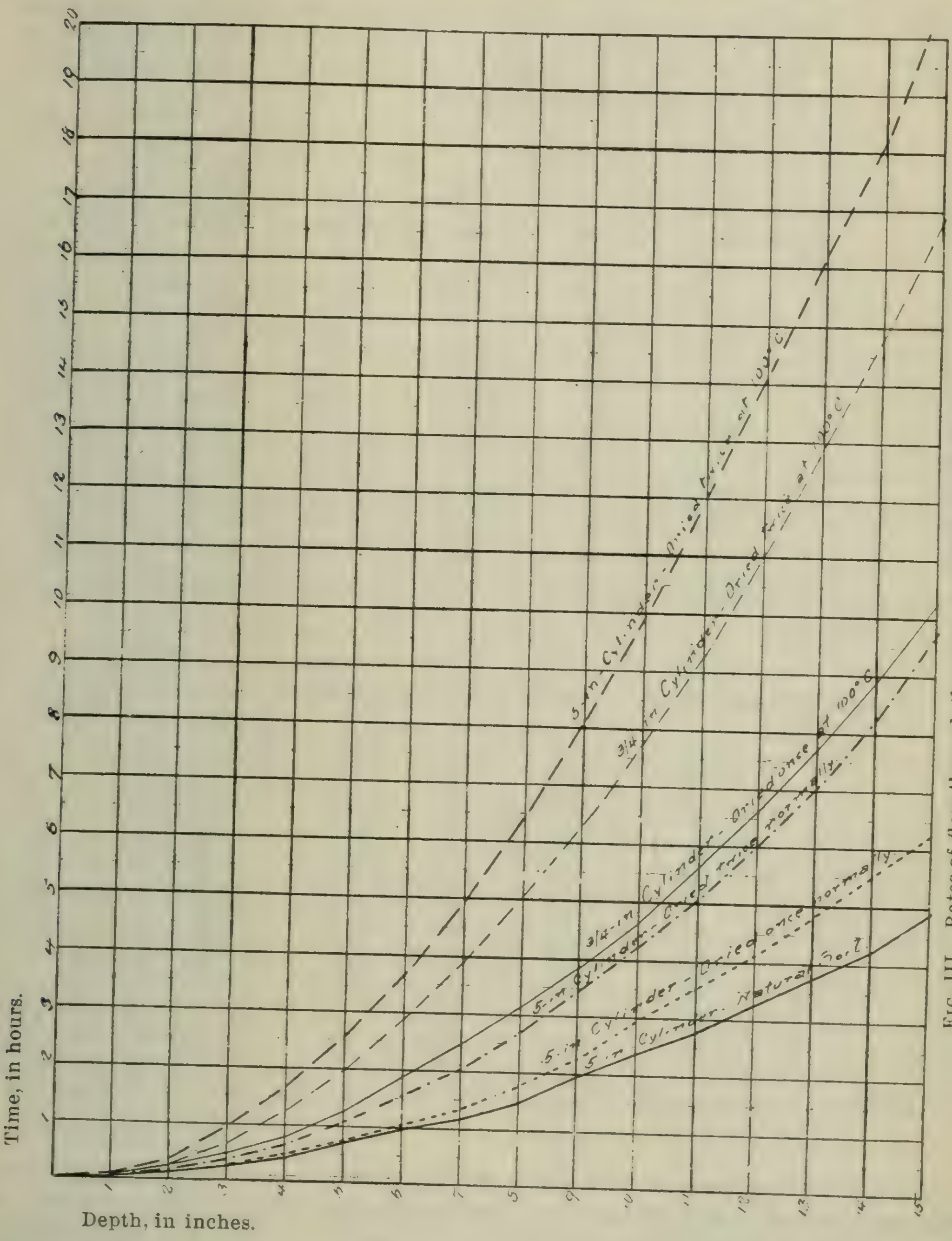


FIG. III. Rates of flow through the same soil dried under different conditions.

It is fair, therefore, to assume that there was some error in the calibration of the old cylinder, and the first two trials may be disregarded in making up the averages and comparisons.

If, then, the averages of the two trials with the 5-inch and $2\frac{3}{8}$-inch cylinders, the third result in the $\frac{3}{4}$-inch, and the one made with the $\frac{7}{16}$-inch are compared, it will be seen that the results at the thirteen-inch mark are within an hour of one another. The differences noted between the cylinders are no greater than those obtained in the same cylinder. It is, therefore, safe to assume that, other things being equal, the diameters of the tubes used in laboratory soil-percolation experiments do not affect the results to any material extent.

TABLE IV. SHOWING THE RATES OF FLOW IN CYLINDERS OF DIFFERENT DIAMETERS, THE SOIL IN EACH CASE BEING FILLED TO THE SAME WEIGHT PER UNIT VOLUME—1.75 GRAMS PER C.C.—NATURAL SOIL BEING USED THROUGHOUT. SURFACES TAMPED.

Depth, in inches.	5-INCH CYLINDER.			$2\frac{3}{8}$-INCH CYLINDER.		
	1st Trial.	2d Trial.	Average.	1st Trial.	2d Trial.	Average.
1	4^{min}	3^{min}	3.5^{min}	5^{min}	3^{min}	4.0^{min}
2	12	11	11.5	19	12	15.5
3	23	17	20.0	23	23	23.0
4	32	25	23.5	31	23	27.0
5	38	33	35.5	38	37	37.5
6	49	39	44.0	50	49	49.5
7	50	52	51.0	58	57	57.5
8	1^{hr} 0	1^{hr} 0	1^{hr} 0.0	1^{hr} 3	1^{hr} 15	1^{hr} 9.0
9	1 6	1 8	1 7.0	1 10	1 10	1 10.0
10	49	1 11	1 0.0	1 5	1 30	1 17.5
11	1 13	1 19	1 16.0	1 23	1 28	1 25.5
12	1 22	1 29	1 25.5	1 36	1 35	1 35.5
13	1 49	1 45	1 47.0	1 33	1 38	1 35.5
Total time	$10^{\text{hrs}}\ 47^{\text{min}}$	$10^{\text{hrs}}\ 52^{\text{min}}$	$10^{\text{hrs}}\ 49.5^{\text{min}}$	$11^{\text{hrs}}\ 34^{\text{min}}$	$12^{\text{hrs}}\ 00^{\text{min}}$	$11^{\text{hrs}}\ 47.0^{\text{min}}$

Depth, in inches.	$\frac{3}{4}$-INCH CYLINDER.			$\frac{7}{16}$-INCH CYLINDER.
	1st Trial.	2d Trial.	3d Trial.	
1	5^{min}	6^{min}	4^{min}	5^{min}
2	19	24	15	12
3	36	31	23	21
4	49	57	30	29
5	56	1^{hr} 0	39	38
6	1^{hr} 12	1 17	43	43
7	1 24	1 33	46	51
8	1 30	1 38	1^{hr} 21	54
9	1 56	1 52	1 24	1^{hr} 4
10	----------	1 55	1 1	1 8
11	----------	----------	1 3	1 20
12	----------	----------	1 1	1 18
13	----------	----------	1 9	1 20
Total time	----------	----------	$10^{\text{hrs}}\ 19^{\text{min}}$	$10^{\text{hrs}}\ 23^{\text{min}}$

So far, the surface of the soil was tamped in each case. Just why this method of bringing the last portion placed in the cylinder down to the mark was preferred to any other, it would be difficult to say; unless it was because it seemed the most natural and rapid. While working with the two smaller tubes the thought came that possibly the tamping would materially affect the rates of flow. This was rendered more probable by the fact that uniform results were extremely difficult to obtain with these cylinders. Therefore, it was decided to make a set of experiments leaving the surface untamped, the soil being brought down to the mark by simple shaking and tapping the sides of the cylinders with a rubber pestle.

TABLE V. SHOWING THE RATES OF FLOW IN CYLINDERS OF DIFFERENT DIAMETERS, NATURAL SOIL BEING USED AND FILLED AS IN TABLE IV. SURFACES NOT TAMPED.

Depth, in inches.	5-INCH CYLINDER.			2⅜-INCH CYLINDER.			1½-INCH CYLINDER
	1st Trial.	2d Trial.	Average.	1st Trial.	2d Trial.	Average.	
1	3$^{\text{min}}$	2$^{\text{min}}$	2.5$^{\text{min}}$	3$^{\text{min}}$	2$^{\text{min}}$	2.5$^{\text{min}}$	3$^{\text{min}}$
2	10	8	9.0	10	8	9.0	8
3	16	15	15.5	17	15	16.0	17
4	23	23	23.0	24	24	24.0	22
5	31	28	29.5	29	31	30.0	29
6	35	35	35.0	31	41	36.0	36
7	44	41	42.5	43	48	45.5	41
8	48	50	49.0	45	1$^{\text{hr}}$ 2	53.5	48
9	53	45	49.0	58	59	58.5	54
10	1$^{\text{hr}}$ 4	56	1$^{\text{hr}}$ 0.0	1$^{\text{hr}}$ 8	1 11	1$^{\text{hr}}$ 9.5	58
11	1 13	1$^{\text{hr}}$ 1	1 7.0	1 9	1 19	1 14.0	1$^{\text{hr}}$ 6
12	1 21	1 9	1 15.0	1 13	1 20	1 16.5	1 7
13	1 13	58	1 35.5	1 20	1 21	1 20.5	1 13
14	1 19	1 10	1 14.5	1 20	1 22	1 21.0	1 19
15	1 41	1 15	1 28.0	1 37	1 25	1 31.0	1 26
Total time	12$^{\text{hrs}}$ 14$^{\text{min}}$	10$^{\text{hrs}}$ 36$^{\text{min}}$	11$^{\text{hrs}}$ 25.0$^{\text{min}}$	12$^{\text{hrs}}$ 7$^{\text{min}}$	12$^{\text{hrs}}$ 48$^{\text{min}}$	12$^{\text{hrs}}$ 27.5$^{\text{min}}$	11$^{\text{hrs}}$ 27$^{\text{min}}$
Total to 13 inches	9 14	8 11	8 42.5	9 10	10 1	9 35.5	8 42

Depth, in inches.	¾-INCH CYLINDER.			$\frac{7}{16}$-INCH CYLINDER.		
	1st Trial.	2d Trial.	Average.	1st Trial.	2d Trial.	Average.
1	3$^{\text{min}}$	3$^{\text{min}}$	3.0$^{\text{min}}$	3$^{\text{min}}$	3$^{\text{min}}$	3.0$^{\text{min}}$
2	9	9	9.0	10	9	9.5
3	16	13	14.5	17	15	16.0
4	18	18	18.0	26	21	23.5
5	28	23	25.5	29	30	29.5
6	30	33	31.5	35	36	35.5
7	37	42	39.5	37	42	39.5
8	44	50	47.0	40	46	43.0
9	42	58	50.0	43	38	40.5
10	46	1$^{\text{hr}}$ 0	53.0	48	57	52.5
11	54	1 12	1$^{\text{hr}}$ 3.0	50	1$^{\text{hr}}$ 3	56.5
12	58	1 21	1 9.5	56	1 18	1$^{\text{hr}}$ 9.0
13	1$^{\text{hr}}$ 3	1 22	1 12.5	1$^{\text{hr}}$ 6	1 15	1 10.5
14	1 5	1 38	1 21.5	1 3	1 39	1 21.0
15	1 8	1 36	1 22.0	1 10	1 45	1 27.5
Total time	9$^{\text{hrs}}$ 41$^{\text{min}}$	12$^{\text{hrs}}$ 18$^{\text{min}}$	10$^{\text{hrs}}$ 59.5$^{\text{min}}$	9$^{\text{hrs}}$ 53$^{\text{min}}$	11$^{\text{hrs}}$ 57$^{\text{min}}$	10$^{\text{hrs}}$ 55.0$^{\text{min}}$
Total to 13 inches	7 28	9 4	8 16.0	7 40	8 33	8 6.5

As was expected, the rates of flow in the different cylinders were materially increased, averaging about two hours faster to a depth of thirteen inches. This emphasizes the importance, in practice, of keeping the surface of the soil loose, thus increasing the amount of irrigation or rain water entering the soil in a given time. Here again, however, some difficulty was experienced in securing uniform results, especially with the smaller tubes. It seemed almost impossible to get a cylinder filled twice in the same way; and the most divergent results were the consequence. Thus, in six trials with the $\frac{3}{4}$-inch and $\frac{7}{16}$-inch cylinders, differences of all the way from four to seven hours were obtained; and these, too, after the most careful weighings and fillings. In sheer desperation the old method of filling in the entire weight of soil at one time, instead of piecemeal to the graduated marks, was

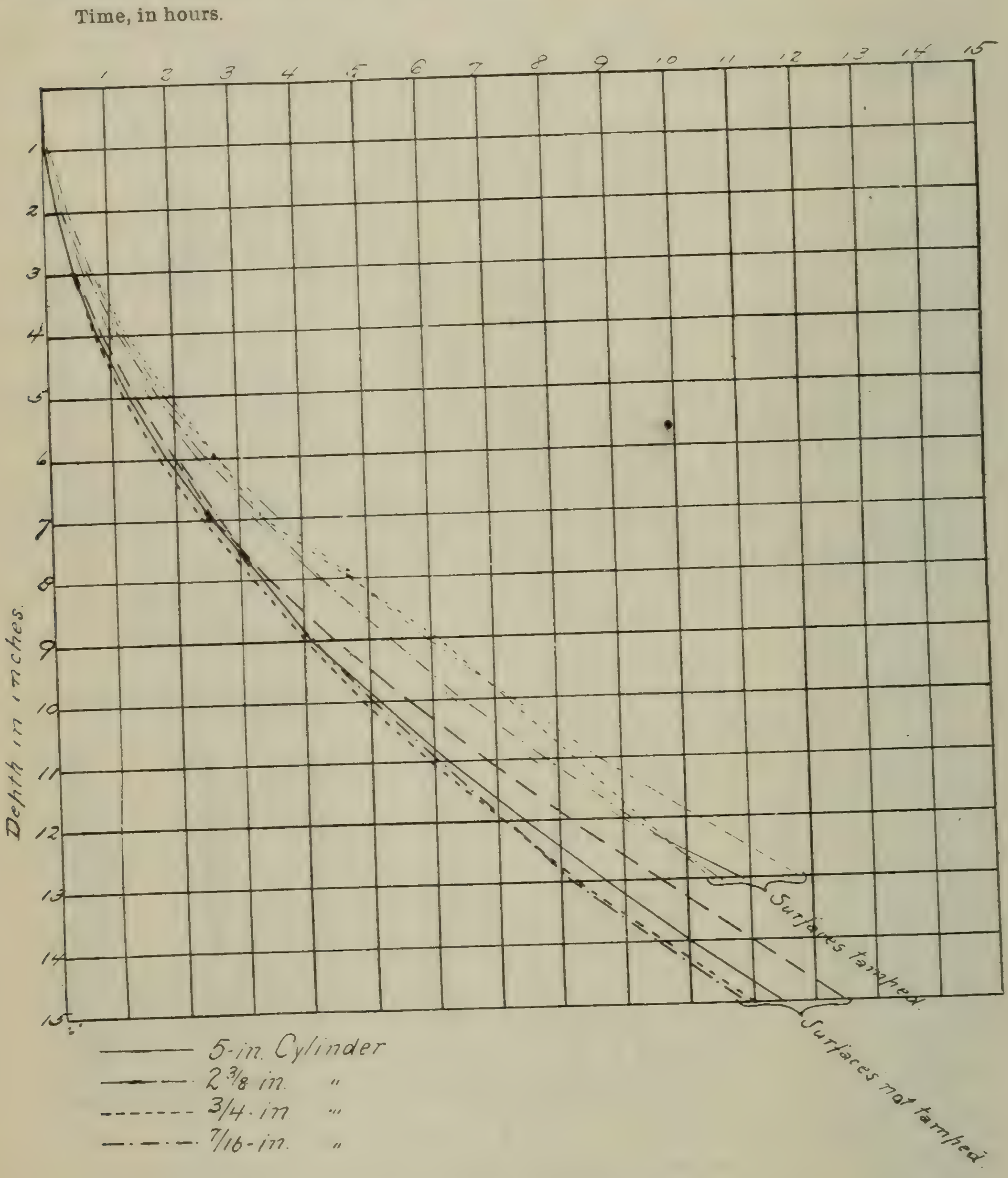


FIG. IV. Rates of flow through cylinders of the same soil of different diameters, with surfaces tamped and not tamped.

resorted to. This was done by tapping the cylinder quite vigorously while pouring in the soil. Then after the entire mass was in, the top end was securely closed, the cylinder inverted, and the soil loosened; then by re-inverting the cylinder and tapping gently the soil was brought to the required top mark. In this way very satisfactory results were obtained. But it served to impress the fact that although the diameters of the cylinders used do not materially affect the rates of flow, it is far more difficult to secure uniform results when cylinders of small diameters—say less than one inch—are used. For in this case much smaller masses of soil are dealt with, and thus small differences count, where they would play but a trifling part in larger masses. In other words, the differences due to packing the cylinders are more "diluted" in the larger soil masses.

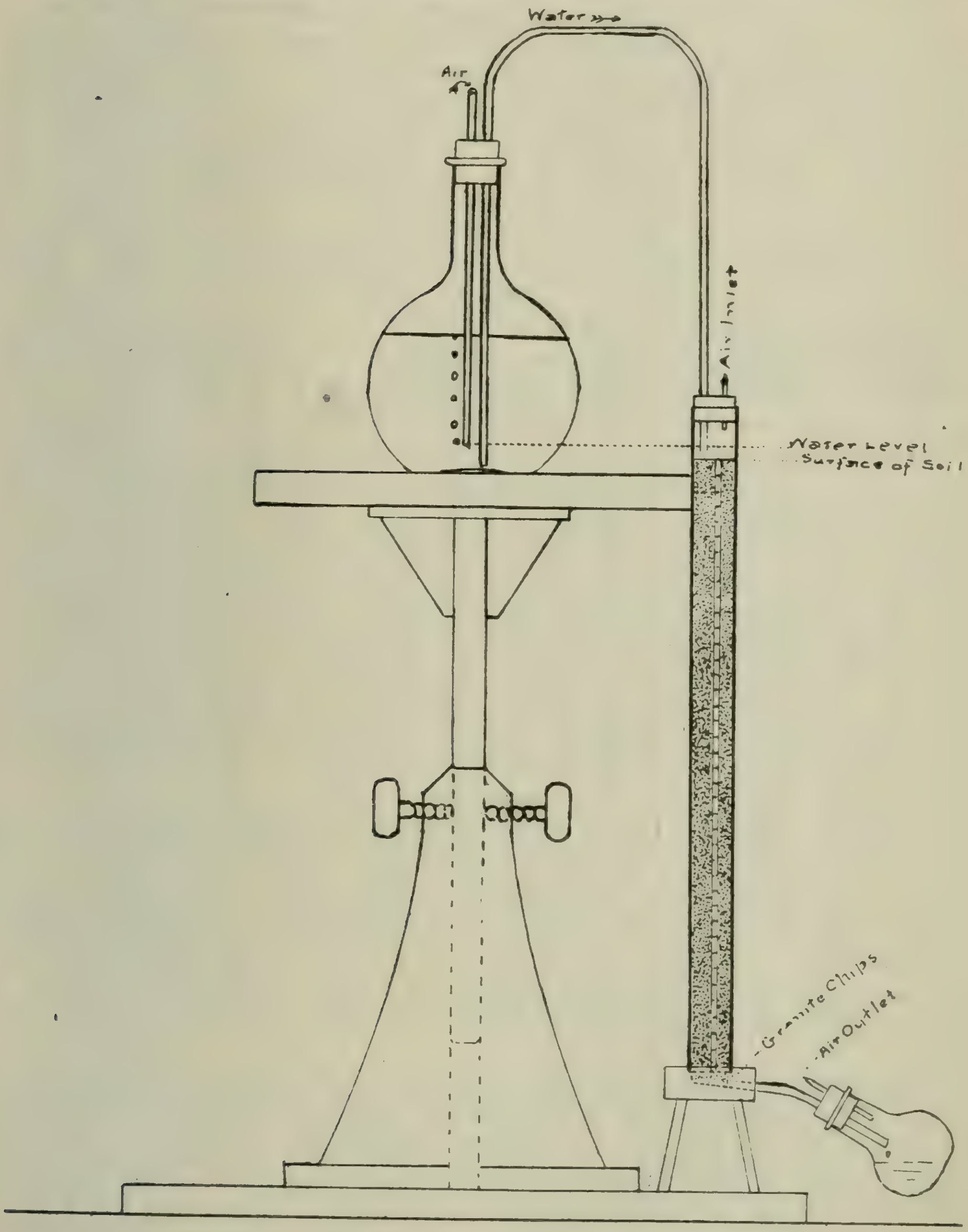


FIG. V. Apparatus for percolation of water through soils.

Apparatus for Comparative Tests.—It has thus been shown that the diameters of the tubes are of no special consequence, but it is more difficult to secure uniform results with those of less than one inch. It was decided, therefore, to use cylinders of not less than $1\frac{1}{2}$ inches in diameter for the experiments with different soils. A length of forty inches for the cylinders was determined upon. Irrigation water should reach to that depth in nearly all cases in California; hence, the desirability of determining the length of time it takes the water to get down that far. In addition, it was hoped that somewhere above this depth existed the theoretical even-rate of flow due to capillarity alone, and that therefore this could be observed and determined for the several soils under investigation. To this depth, however, no even-rate flow was obtained in any case, as the data hereinafter presented will show.

It was thought important to secure the percolated water for analysis; some arrangements were, therefore, necessary to secure and measure it. The first trials were made by simply placing the cloth bottom of the cylinder over a funnel and allowing the percolate to drip into an open vessel. This was found to be very unsatisfactory, not only on account of the inconvenience in measuring the flow and preventing evaporation, but also on account of excessive fungous and algous growths which followed in consequence of the exposure of the damp cloth bottom to light and air. These growths completely filled the funnels, and had to be removed from time to time; but they eventually stopped the flow entirely. A more convenient arrangement was devised as follows: The bottom of the cylinder was sunk to the depth of one quarter inch into a thick (two-inch) block of wood, by first boring out a hole of the same diameter as the outside of the cylinder. In the bottom of this hole a smaller one corresponding to the inside diameter of the cylinder was bored to a depth of one inch. This smaller hole thus formed a cavity beneath the cylinder, from which an outlet tube was provided. The cavity in the block was well paraffined and waxed to make it water-tight, and filled with coarse fragments of granite, over which was pasted a perforated disk of filter paper. The cylinder was filled to the proper mark and secured on top so as to allow it to be inverted. The cloth bottom was removed, and the block of wood put in place—also inverted. Then by simply turning the whole arrangement upright, the column of soil rested on the layer of granite fragments, unexposed to light and with a minimum exposure to air.

The outlet tube led into a weighed flask, provided with a vent-tube drawn to a fine opening to avoid evaporation while allowing the air to escape. The water was maintained automatically at a depth of one half inch on top of the soil by means of a Marriotté arrangement; thus evaporation was avoided, and entrance of air at the top end of the cylinder permitted as in the receiving flask. The whole arrangement is illustrated in the figure on page 163.

Preparation of Soils for Comparative Tests.—The old method of filling-in the soil piecemeal was discarded as likely to lead to nonuniform conditions in the cylinders. Instead, the entire quantity of soil was weighed out and placed on a sheet of stiff paper a trifle longer than the cylinder. There it was thoroughly mixed and spread out in a long, narrow strip. The paper was rolled up around this strip of soil, forming a cylinder small enough to fit into the glass tube. By pushing the paper roll of soil as far as possible into the cylinder lying horizontally, and then quickly turning the whole into a vertical position, the soil was dropped in the cylinder in one mass. The paper was then carefully and slowly drawn out, the cylinder being tapped gently all the while. In this way the soil was easily and uniformly brought down to the mark, and all the old trouble with the uneven distribution of the soil particles, when poured into the cylinders, was avoided.

Rates of Flow Through Different Soils.—For the purpose of a comparative study of the rates of flow through different soils, three typical soils were selected. For a clay soil the black adobe of the University grounds, for a loam a fine Yuba County loam, and for a sandy soil, one from the plains of Stanislaus County were taken. These were carefully broken up with a rubber pestle, and the coarse particles removed by passing through an ordinary flour-sieve. It was determined to adopt some standard of compactness for each soil, in order that some definite knowledge might be obtained of the conditions influencing the rate of flow of the percolating water.

TABLE VI. SHOWING THE RATES OF FLOW THROUGH DIFFERENT SOILS WITH DIFFERENT PERCENTAGES OF INTERSPACE.

Depth, in inches.	Black Adobe, University Grounds. 42.83% Interspace.	Loam Soil, Yuba Co. 57.36% Interspace.	Sandy Soil, Stanislaus Co. 35.59% Interspace.	Sandy Soil, Stanislaus Co. 37.10% Interspace.
2	24$^{\text{min}}$	24$^{\text{min}}$	15$^{\text{min}}$	15$^{\text{min}}$
4	1$^{\text{hr}}$ 7	1$^{\text{hr}}$ 15	59	45
6	1 46	1 37	1$^{\text{hr}}$ 40	1$^{\text{hr}}$ 6
8	2 31	2 32	2 36	1 30
10	3 24	3 0	3 10	2 7
12	4 5	3 36	4 17	2 36
14	4 7	3 36	5 39	2 47
16	4 6	3 48	6 33	2 48
18	4 42	4 6	8 0	3 12
20	5 53	4 19	9 39	3 48
22	5 55	4 53	10 12	4 36
24	5 54	5 32	10 39	5 24
26	5 41	6 4	10 31	6 0
28	6 0	6 31	10 44	6 0
30	8 25	7 23	11 3	6 0
32	8 24	7 21	11 27	6 6
34	9 29	7 9	12 13	6 18
36	10 7	7 6	11 48	6 12
38	9 30	8 6	13 29	6 24
40	12 12	8 0	13 26	6 54
Total time	113$^{\text{hrs}}$ 42$^{\text{min}}$	96$^{\text{hrs}}$ 18$^{\text{min}}$	158$^{\text{hrs}}$ 20$^{\text{min}}$	80$^{\text{hrs}}$ 48$^{\text{min}}$

None will doubt the fact that the smaller the particles making up the soil, the smaller will be the capillary spaces between the particles, and consequently the slower will be the rate of flow. Likewise, then, by increasing or decreasing the percentage of interspace, we can materially affect the rate of flow through the same soil. In order to determine and study just how far these rates of flow could be controlled, the data resulting from a measurement of the percentages of the interspaces was thought valuable, and hence care was taken to obtain them.

The standard of compactness for each class of soils was obtained by weighing the quantity which could be conveniently settled or compacted into 100 c.c. of space by tapping the sides and bottom of the cylinder—not by tamping the soil itself. The weight of soil thus obtained was adopted as the weight per unit of volume throughout the experiments with that soil. In this way the standard of 140 grams per

100 c.c. for the University black adobe, for the Yuba County loam 110 grams, and for the Stanislaus sandy soil 170 grams were obtained.

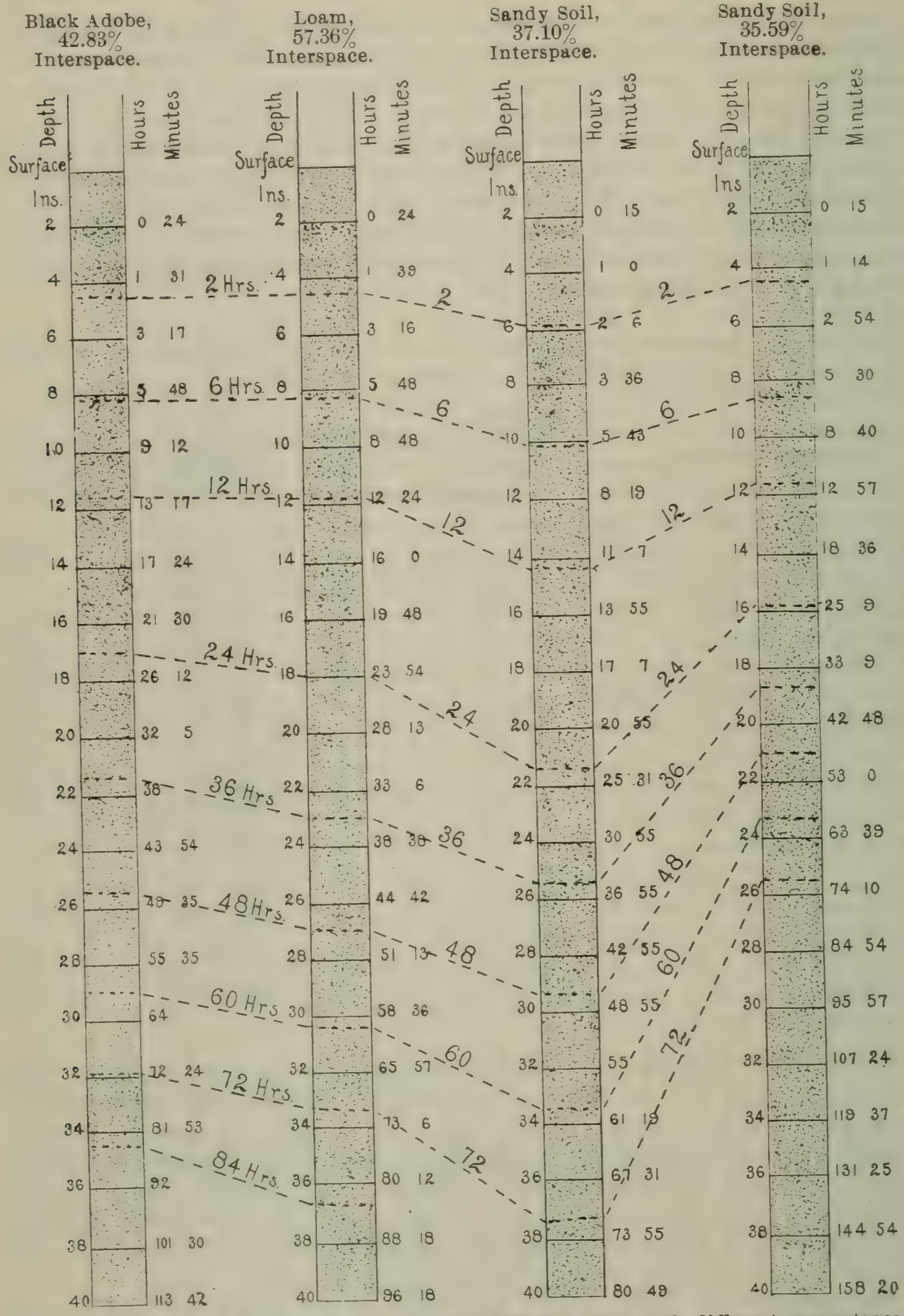


FIG. VI. Differences in rates of flow through different soils, with different percentages of interspace.

Table VI and Fig. VI give the results of the experiments with the three soils filled into the cylinders in accordance with the standards noted above. They show a most surprising condition of affairs. The sandy soil, which it was confidently expected would show the fastest rate of flow, was very much the slowest of the three almost from the start, being sixty-two hours behind the loam and forty-five hours behind the black adobe at the forty-inch mark. Evidently if the hypothesis above mentioned be true, the sandy soil had been proportionally more compacted than the other two. Fortunately the amounts of water necessary to saturate the soils were determined, and from these it was hoped some data regarding the percentages of interspaces could be determined. When these were computed, the percentages found were 34.83 per cent for the black adobe, 51.94 per cent for the loam, and 29.42 per cent for the sandy soil. From these it will be seen that the sand actually had the lowest percentage of interspace. In order to test the effect of an increase of the interspace a new experiment was made with the sandy soil at a less weight per unit volume. Only a small reduction was made, however, as it was realized that if packed two loosely in the cylinder, the soil would not "stand-up" when it was wetted. Consequently, 166 grams per 100 c.c. were used instead of 170 grams as in the former experiment. The increase in the rate of flow was most surprising, the water going through in just about half the time, or 80 hours 54 minutes as against 158 hours 20 minutes. It is evident, therefore, that it takes only a small reduction in the percentage of interspace to affect very materially the rate of flow. When the interspace percentage was computed, however, the water required to saturate showed only 28.17 per cent as against 29.42 per cent in the former experiment when more soil per unit volume was used. A close examination of the cylinder showed that the water did not completely fill the interspace, and hence this method of computing its percentage was assumed to be unreliable. Whitney's formula for determining the interspace percentage, given by Wiley (Agricultural Analysis, Vol. I, p. 134), was then used to obtain a nearer approximation of the percentages existing in the cylinder, as follows:

$$s = \frac{(v - \frac{w}{co}) \times 100}{v}$$

s = per cent by volume of interspace.
v = volume of tube, in c.c.
w = weight of soil, in grams.
co = specific gravity of the soil particles.

The specific gravities of the soil particles were determined with a pycnometer, and were found as follows; two determinations were made in each case and the averages between the two selected:

	1st Trial.	2d Trial.	Average.
Black adobe	2.44	2.46	2.45
Yuba County loam	2.60	2.56	2.58
Stanislaus County sand	2.65	2.63	2.64

The corrected interspace percentages, as computed with the formula, were found as follows:

Black adobe	140 grs. per 100 c.c.	42.83%
Yuba County loam	110 " " " "	57.36%
Stanislaus County sand	170 " " " "	35.59%
Stanislaus County sand	166 " " " "	37.10%

The formula percentages are higher in all cases than those given by the water computation. Although the sandy soil used in the second experiment had a lower interspace percentage than either of the other two, it gave the fastest rate of flow; viz., 80 hours 54 minutes. It seems only natural that this should be the case. The average size of the particles is larger and hence the capillary space between them is also relatively larger. The water then has less friction to overcome in its descent. Then, too, it has relatively a smaller number of soil particles to pass, and consequently less surface to wet. We know, too, that an increase in the number of grains per unit of soil increases the water-holding capacity, due to the increased surface exposed to the action of the surface tension of the water around the grains. This force undoubtedly has a retentive power which must be overcome either by the force of gravity from below or pressure from above before the water can proceed downward. From this standpoint it is easy to see how the rates of flow through the Yuba loam and the University black adobe were so much slower—16 and 33 hours respectively—with the comparatively larger percentages of interspace. The grains in these two soils were much finer than in the Stanislaus sand—just how much was not determined, but the difference could be easily noted by the eye.

The writer will not hazard an explanation of the enormous difference in the rate of flow due apparently to the small difference in the per cent of interspace in the two experiments with the Stanislaus soil, at least not until the subject can be further investigated. Suffice it to say that it but impresses the truth of the contention made in the beginning of this paper; viz., the extreme liability of laboratory experiments of this kind to variable results, unless a full knowledge and control of all conditions are obtained before comparisons and deductions are made.

Rate of Percolation from the Soil Columns.—So far, only the rates of flow within the soils themselves have been treated. Appended is a table showing the quantities of water percolated from the several soil columns under investigation. It will be noticed that so long as the water remained on the surfaces the rates of percolation remained fairly constant. The Stanislaus soil was somewhat variable at first, but after the water was removed from the surface, the excess above the capacity of the soil allowed to percolate, and then the water replaced on the surface, the percolation became more nearly uniform.

The figures of the total quantities percolated after the removal of the water from the surface bring out some interesting points. The Yuba loam stopped running in 19½ hours, allowing only 13.5 c.c. through. The Stanislaus sand with the lower percentage of interspace gave up the water much more slowly and gradually, continuing to run for six days with a total of only 12.5 c.c. With the larger interspace per cent the flow stopped after the first day, allowing 15 c.c. to pass through in that time. When the water was replaced on the surface, the Yuba loam began running in one hour after replacement, while the Stanislaus sand required seven hours to reach again the point of saturation. The importance of knowing the time required to saturate the soil to the requisite depth in irrigation operations is here shown. Continuing too long not only allows the water to run away, but also leaches out soluble plant-food. Too short a time does not allow the entrance of sufficient water to reach the required depth.

TABLE VII. Showing Quantities of Water Percolated from Columns of Soil 40 inches High and 1½ inches in Diameter.

Time.	Black Adobe, University Gr'nds, 42.83% Air Space, 1680 Grams Soil.	Loam Soil, Yuba County, 57.36% Air Space, 1292.5 Grams Soil.	Sandy Soil, Stanislaus County, 35.59% Air Space, 2040 Grams Soil.	Sandy Soil, Stanislaus County, 37.10% Air Space, 1950 Grams Soil.
One Half Inch of Water on Top.				
1st 24 hours	27 c.c.	47 c.c.	22.5 c.c.	50 c.c.
2d 24 hours	29	46	19.5	47
3d 24 hours	25	46	15.0	35
4th 24 hours	23	44	17.0	--
5th 24 hours	22	43	16.0	--
6th 24 hours	23	43.5	16.0	--
7th 24 hours	--	41.5	----	--
After Removal of Water from the Surface.				
1st 24 hours	(*b*)	(*a*) 13.5 c.c.	5.5 c.c.	----
2d 24 hours	--	13.5	2.0	15.0 c.c.
3d 24 hours	--	0.0	1.5	0.0
4th 24 hours	--	0.0	1.5	---
5th 24 hours	--	0.0	1.5	----
6th 24 hours	--	0.0	.5	----
7th 24 hours	--	0.0	.0	----
Total after removal	--	13.5 c.c.	12.5 c.c.	15.0 c.c.
Began running in	--	1 hour	7 hours	----
After Replacing One Half Inch of Water on Top.				
1st 24 hours	------	65 c.c.	17 c.c.	------
2d 24 hours	------	59	20	------
3d 24 hours	------	38	20	------
4th 24 hours	------	58	20	------
5th 24 hours	------	56	19	------
6th 24 hours	------	54	19	------
7th 24 hours	------	61	18	------
8th 24 hours	------	61	17	------
9th 24 hours	------	59	18	------
10th 24 hours	------	57	17	------
11th 24 hours	------	--	17	------
12th 24 hours	------	--	18	------

(*a*) Stopped flowing 19½ hours after removal of water from the surface.
(*b*) Flow stopped on account of clogging by fungous growth.

Materials Dissolved by Percolating Water.—Each 100 c.c. of percolate from the several soils was analyzed, in order to determine the quantities of soluble salts leached out by the water. The results of these analyses are given in Table VIII, and serve to show the enormous amounts of soluble material the percolating water is capable of removing. It would hardly be safe, however, to base estimates upon these figures of the amounts of salts actually dissolved by the percolating water in nature. In the field there may be modifying conditions. It must not be forgotten that not only were these cylinders of soil made up of uniformly mixed soils throughout their lengths, but the compactness or quantity per unit volume was arbitrarily adopted without reference to field conditions. The figures are valuable and interesting, however, as they show what actually can take place, and to what extent leaching may deplete the soils. One of the surprising features of the analysis is the comparatively large proportion of "alkali salts" shown, even in the

University black adobe and the Yuba loam, both of which were never suspected of the slightest "taint." It will be noticed that the content of sodium carbonate increased in the first three percolates from all three soils. Undoubtedly we have here an example of the conversion of the sulfate into carbonate, a change which the investigations of Professors Hilgard and Jaffa have shown to take place in the presence of an excess of water in alkaline salts.

TABLE VIII. Showing the Amounts and Kinds of Material—in Grains per Gallon—Progressively Removed by Percolating Water, from Cylinders of Soil 40 inches Long and 1½ inches in Diameter.

	Black Adobe, University Gr'nds. (1680 grams of soil.)		Sandy Soil, Stanislaus County. (2040 grams of soil.)		
	1st Percolate 104 c c.	2d Percolate 56 c.c.	1st Percolate 106 c.c.	2d Percolate 108 c.c.	3d Percolate 124 c.c.
Potassium sulfate and sodium sulfate	53.30	85.10	26.98	3.72	.23
Magnesium nitrate	-----	-----	1.25	-----	-----
Sodium chlorid	11.80	-----	35.22	.70	1.98
Sodium carbonate	1.76	2.45	1.25	6.20	6.81
Calcium carbonate	-----	4.02	28.70	0.00	-----
Magnesium carbonate	129.10	2.92	19.56	15.65	19.58
Calcium sulfate	-----	105.10	84.20	0.00	-----
Silica	.53	1.40	6.08	5.14	4.45
Organic matter and chemically combined water	52.30	38.20	92.00	14.55	8.06
Totals	248.79	239.19	295.24	45.96	41.11

	Loam Soil, Yuba County. (1292.50 grams of soil.)						
	1st Percolate 100 c.c.	2d Percolate 147 c.c.	3d Percolate 128 c.c.	4th Percolate 128 c.c.	5th Percolate 116 c.c.	6th Percolate 112 c.c.	7th Percolate 122 c.c.
Potassium sulfate and sodium sulfate	42.00	7.00	3.22	1.05	.18	2.15	.72
Magnesium nitrate	-----	-----	-----	-----	-----	-----	-----
Sodium chlorid	26.41	4.74	-----	1.35	1.35	1.35	.72
Sodium carbonate	1.23	19.78	21.66	19.78	18.59	15.55	14.25
Calcium carbonate	7.83	2.91	2.80	1.98	4.31	2.22	.82
Magnesium carbonate	26.80	10.22	4.78	8.00	4.67	5.44	4.66
Calcium sulfate	16.48	1.69	2.40	0.00	0.00	0.00	0.00
Silica	1.75	.70	.70	0.00	.18	0.00	0.00
Organic matter and chemically combined water	91.50	21.00	17.00	12.40	10.48	9.17	8.65
Totals	214.00	68.04	52.56	44.56	39.76	35.88	29.82

The total salts extracted by the first percolates were enormously higher than the second in both the Yuba and Stanislaus soils. The University black adobe did not show so remarkable a falling-off, but as in that case the second percolate was only half the quantity of the first, it is not fairly comparable with the others. After the second percolate the falling-off was not so great, and proceeded, on the whole, more gradually from period to period.

Effect of Alkali Salts in Percolating Water.—When these investigations were undertaken, it was hoped that a full set of experiments could be completed with percolating water containing different percentages of the alkaline salts commonly found in California waters. In this the writer was disappointed, however, chiefly on account of the lack of time at command to devote to the work. The experiments with saline waters, therefore, went no farther than tests of two percentages of sodium carbonate—.1 per cent and .25 per cent.

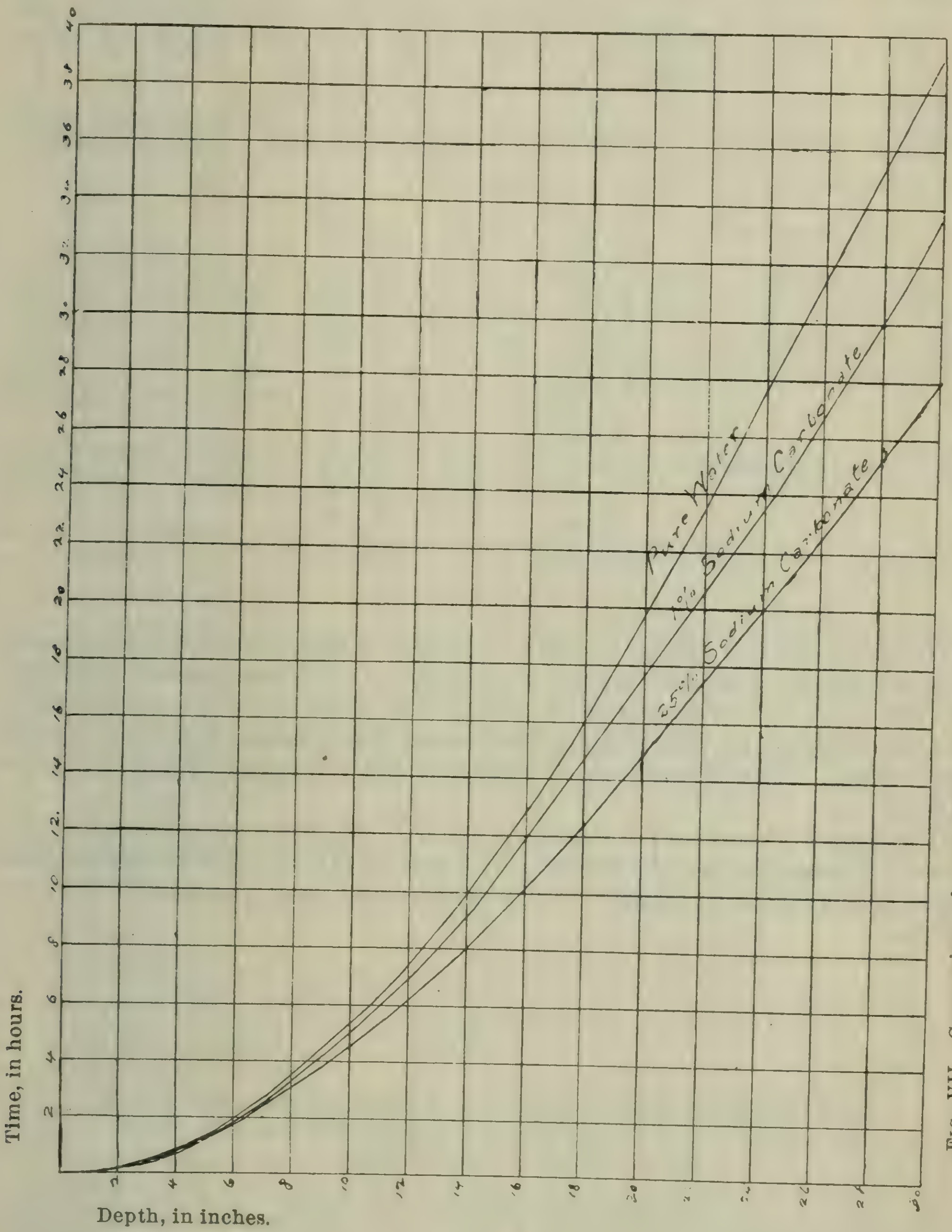


FIG. VII. Comparison of rates of flow of pure water and of solutions of sodium carbonate through soils.

The figures yielded by these experiments are given herewith, chiefly as a matter of record. It is manifestly out of the question to attempt any intelligent discussion of the subject upon these data alone, and none will be attempted here. Attempts were made to measure the quantities of percolated solutions from the different cylinders, as was done in the cases of the several soils. It was thought that the carbonate would in time act upon the soil in some way and thus cause a diminution of the rate of percolation. The results of these measurements show a diminution in all three cases, more so with the alkaline waters.

TABLE IX. Showing the Rates of Flow of Pure Water and Solutions Containing .1% and .25% Sodium Carbonate Respectively, Through Soil from Pomona Station Tract, used at 175 grams per 100 c.c. in Each Case.

Depth, in inches.	Pure Water.	Water containing .1% Sodium Carbonate.	Water containing .25% Sodium Carbonate.
2	11$^{\text{min}}$	11$^{\text{min}}$	11$^{\text{min}}$
4	39	34	31
6	1$^{\text{hr}}$ 7	1$^{\text{hr}}$ 3	1$^{\text{hr}}$ 3
8	1 28	1 30	1 16
10	1 53	1 44	1 23
12	2 7	1 58	1 42
14	2 35	2 12	1 57
16	2 50	2 42	2 1
18	3 10	2 54	2 16
20	3 48	2 54	2 30
22	3 48	2 54	2 34
24	4 0	2 54	2 30
26	3 45	3 6	2 30
28	4 0	3 20	3 00
30	3 48	3 49	2 36
Total time	39$^{\text{hrs}}$ 18$^{\text{min}}$	32$^{\text{hrs}}$ 45$^{\text{min}}$	28$^{\text{hrs}}$ 00$^{\text{min}}$

The data are not given, however, for the reason that the experiments were conducted with the funnel and open-bottle arrangement for catching the drip, in consequence of which the cloth bottoms undoubtedly became clogged by the fungi which were found to grow so luxuriantly upon them. The figures thus obtained are therefore considered unreliable.

It is hoped that these investigations will be fully carried out in the future, if possible, by the writer, for even so far as these meager figures show, the subject promises many interesting and profitable developments.

MECHANICAL AND CHEMICAL EXAMINATION OF SOILS.

By R. H. Loughridge.

No. 2214. *Volcanic ash soil* from a few miles east of Placerville, El Dorado County; sent by E. L. Turner. The soil is a deep red clay, increasing in color in the lower depths. It represents a belt of land reaching northward to Chicago Park and having an elevation of about 2000 feet above the sea. Its mechanical composition, as determined by R. K. Bishop, is shown in the following table:

No. 2214. MECHANICAL COMPOSITION OF VOLCANIC ASH SOIL.

Hydraulic Value. Velocity per Second.	Diameter of Grains.	Physical Characteristics.	Per Cent.
Above 64 mm.	Above .50 mm.	Grits	.36
64 mm.	.50 –.30 mm.	Very coarse sand	3.01
64 –32 mm.	.30 –.16 mm.	Coarse sand	6.24
32 –16 mm.	.16 –.12 mm.	Medium sand	7.95
16 – 8 mm.	.12 –.072 mm.	Fine sand	14.11
8 – 4 mm.	.072 –.047 mm.	Coarsest silt	8.54
4 – 2 mm.	.047 –.036 mm.	Coarse silt	5.69
2 – 1 mm.	.036 –.025 mm.	Medium silt	3.10
1 – 0.5 mm.	.025 –.016 mm.	Fine silt	3.89
0.5 – 0.25 mm.	.016 –.0023 mm.	Finest silt	23.30
0.25– ?	.0023– ?	Colloid clay	15.20
		Total	91.39

The percentage of clay and very fine silt is seen to be very large; in fact, the entire mass of the soil seems to be made up chiefly of silt. Under the microscope the grains appear as much-rounded quartz pellets, highly coated with iron oxid. When this coating is removed by acid the grains are perfectly white and opaque.

The chemical composition of the soil is shown in the following table; the analysis was made by George E. Colby:

No. 2214. CHEMICAL COMPOSITION OF VOLCANIC ASH SOIL.

		Per Cent.
Insoluble matter	25.62	46.19
Soluble silica	20.57	
Potash		.31
Soda		.09
Lime		.38
Magnesia		.69
Br. ox. of manganese		.08
Peroxid of iron		13.99
Alumina		24.09
Phosphoric acid		.15
Sulfuric acid		.02
Water and organic matter		13.81
Total		99.80
Humus		1.00
Humus ash		1.01
Humus nitrogen, per cent in humus		5.60
Humus nitrogen, per cent in soil		.056
Available potash	citric acid method	.034
Available phosphoric acid		.048
Hygroscopic moisture		11.80

The analysis shows that this soil contains a fair amount of potash, and is quite rich in phosphoric acid; but the percentage of lime is far too low for a soil so highly ferruginous and clayey.

The fact is also shown that (as is commonly the case in highly ferruginous soils) a large part of the phosphoric acid is locked up in combination with the iron, leaving only about .05 per cent available to plants. It is believed that the application of air-slaked lime to this soil will release some of the phosphoric acid from that combination and gradually thus increase the available percentage.

THE SOILS OF POTTER VALLEY.

Potter Valley lies about thirty miles north of the town of Ukiah, Mendocino County, and embraces the headwaters of the east fork of Russian River. It has a width of about two miles, and a length, north and south, of about seven miles, and is bordered on all sides by ranges of mountains, forming the watershed from which the valley is well supplied with water. The surface of the valley is highest on the north, and the streams forming the east fork thus flow southward, and uniting find their way out through a cañon; after passing through Coyote Valley they unite with the main Russian River.

The mountains on the north of the valley form the divide between the headwaters of Russian and Eel rivers, the latter flowing northwestward and the former southward, each, after winding wildly among the mountains, finding its outlet to the Pacific.

The mountains are partly covered with oaks, madrone, and manzanita; the valley is dotted with live and white oaks, the northern part being more heavily timbered than the southern. The accompanying view (Plate 1) of the valley was taken looking southwest from a hill northeast of the village of Potter Valley.

The soils of the valley are dark yellowish loams, rich and quite deep, there being but little change, except in the humus, down to a depth of twenty or twenty-five feet. Below this depth there is a very thick bed of blue clay impervious to water and said to have a thickness of two hundred feet in the upper or northern end of the valley and three hundred and seventy-five feet in the southern or lower end. In the digging of wells, water is usually found upon this clay bed.

The nature of the soil of the upper part of the valley is shown in the following analyses, both physical and chemical:

No. 2243. *Loam soil* from one mile north of the town of Potter Valley, Mendocino County. The soil is a yellowish, silty loam, underlaid by a subsoil of the same nature. It was taken in the edge of a grove of very large oaks. The analyses were made by Mr. E. H. Lea, formerly a student in the laboratory of the Agricultural College, and now chemist of a large sugar plantation in the Hawaiian Islands.

No. 2243. Physical Analysis of Soil from Potter Valley.

Hydraulic Value Velocity per Second.	Diameter of Grains.	Physical Characteristics.	Per Cent.
64 mm.	.50 –.30 mm.	Very coarse sand	4.00
64 –32 mm.	.30 –.16 mm.	Coarse sand	4.20
32 –16 mm.	.16 –.12 mm.	Medium sand	5.95
16 – 8 mm.	.12 –.072 mm.	Fine sand	10.00
8 – 4 mm.	.072 –.047 mm.	Coarse silt	10.00
4 – 2 mm.	.047 –.036 mm.	Coarse silt	11.30
2 – 1 mm.	.036 –.025 mm.	Medium silt	7.20
1 – 0.5 mm.	.025 –.016 mm.	Fine silt	4.27
0.5 – 0.25 mm.	.016 –.0023 mm.	Finest silt	10.60
0.25– ?	.0023– ?	Colloid clay	28.40
		Total	95.92

The percentage of colloid clay and very fine silt is very large, and indicates a close texture, as well as durability in the soil. The grains

PLATE 1. General View of Potter Valley, Mendocino County, Looking Southwestward.

are made up of angular particles of quartz, both opaque and transparent, and of the country rock; no volcanic material was observed.

The character of the grains shows that the soils are derived from the rock formations of the bordering mountains through long processes of disintegration and decomposition, the material being deposited in the quiet waters of an ancient inland lake.

No. 2243. Chemical Analysis of Soil of Potter Valley.

	Per Cent.
Coarse materials > 0.5mm	5.0
Fine earth	95.0

Analysis of Fine Earth.

Insoluble matter	66.53	72.07
Soluble silica	5.54	
Potash (K_2O)		.95
Soda (Na_2O)		.41
Lime (CaO)		1.40
Magnesia (MgO)		2.55
Br. ox. of manganese (Mn_3O_4)		.03
Peroxid of iron (Fe_2O_3)		6.24
Alumina (Al_2O_3)		7.46
Phosphoric acid (P_2O_5)		.15
Sulfuric acid (SO_3)		.06
Carbonic acid (CO_2)		------
Water and organic matter		8.78
Total		100.10
Humus		1.0
Humus ash		.63
Available phosphoric acid		.01
Hygroscopic moisture (absorbed at 14° C.)		10.41

The analysis shows that the soil is rich in each of the elements of plant-food—potash, lime, phosphoric acid, and humus—and the percentage of each is somewhat above that of the average of the soils of the State.

ARROYO GRANDE VALLEY.

The valley of Arroyo Grande, in the southern part of San Luis Obispo County, is noted among seedsmen of the United States as being capable of producing vegetable seeds of maximum value, and as having won prizes offered by one of the prominent firms of the Eastern States.

The sample of soil examined represents the land in the vicinity of the town of Arroyo Grande. A short distance to the eastward the valley is quite narrow, but on the west toward the coast it becomes very wide. The soil is for the most part a heavy dark clay, blackish on the west of the town and very rich. Still westward the valley ends in the sandhills of the coast.

The accompanying engraving (Plate 2) gives a view of the valley, with the town of Arroyo Grande in the distance.

The composition of the soil is shown in the following analyses made by F. R. Wertmueller, a graduate student in the department, now assistant in the Hawaiian experiment station.

PLATE 2. ARROYO GRANDE VALLEY, SAN LUIS OBISPO COUNTY.

No. 2061. *Clay soil* of the Arroyo Grande Valley, San Luis Obispo County.

No. 2061. MECHANICAL ANALYSIS OF ARROYO GRANDE VALLEY SOIL.

Hydraulic Value. Velocity per Second.	Diameter of Grains.	Physical Characteristics.	Per Cent.
64 mm.	.50 –.30 mm.	Very coarse sand	------
64 –32 mm.	.30 –.16 mm.	Coarse sand	------
32 –16 mm.	.16 –.12 mm.	Medium sand	.04
16 – 8 mm.	.12 –.072 mm.	Fine sand	.40
8 – 4 mm.	.072 –.047 mm.	Coarsest silt	3.89
4 – 2 mm.	.047 –.036 mm.	Coarse silt	2.70
2 – 1 mm.	.036 –.025 mm.	Medium silt	7.40
1 – 0.5 mm.	.025 –.016 mm.	Fine silt	2.30
0.5 – 0.25 mm.	.016 –.0023 mm.	Finest silt	53.01
0.25– ?	.0023– ?	Colloid clay	26.38
		Total	96.12

The amount of very fine material in this soil is very large, that of silt alone comprising more than one half of the weight. The water capacity of the land is therefore great—the saturation point being 67 per cent by volume and 77 per cent by weight.

No. 2061. CHEMICAL ANALYSIS OF ARROYO GRANDE SOIL.

Coarse materials > 0.5mm	none.
Fine earth	all.

Analysis of Fine Earth.

		Per Cent.
Insoluble matter	53.43	72.43
Soluble silica	19.00	
Potash (K_2O)		.67
Soda (Na_2O)		.18
Lime (CaO)		2.11
Magnesia (MgO)		2.26
Br. ox. of manganese (Mn_3O_4)		.06
Peroxid of iron (Fe_2O_3)		5.23
Alumina (Al_2O_3)		7.40
Phosphoric acid (P_2O_5)		.71
Sulfuric acid (SO_3)		.22
Carbonic acid (CO_2)		1.82
Water and organic matter		6.63
Total		99.72
Humus		3.06
Humus ash		1.77
Humus nitrogen, per cent in humus		21.96
Humus nitrogen, per cent in soil		.67
Available potash	citric	0.144
Available phosphoric acid	method	0.139
Hygroscopic moisture		10.70

This soil is very rich in all of the elements of food that are available to plants. The potash is a little lower than the general average (0.7) of the soils of the State thus far examined, but is still far above the needs of the plant for very many years. Calculated per acre, there are 26,800 pounds per foot in depth—the minimum requirement for fertility being about 20,000 pounds. The lime is abundant also.

Phosphoric acid is present in larger amounts than found thus far in any of the soils of the State. The average for the State at large is a little more than one tenth of one per cent; a number of soils have as much as three tenths, the soil of Carisa Plain, in San Luis Obispo, four tenths, while the shell land of Bay Island Farm has seven tenths, due chiefly to the shell deposits. The above soil, however, though of an inland valley, has .71 per cent, which is equivalent to 28,400 pounds per acre to a depth of one foot. For fertility this land need have only about 4,000 pounds. The portion of phosphoric acid immediately available in this soil is more than this, and it is clear that neither phosphate nor potash fertilization will be needed for very many years.

The nitrogen and humus are also present in larger amounts than usual for semi-arid lands of this Coast.

THE VALLEY AND MESA LANDS OF SAN GORGONIO PASS.

San Gorgonio Pass, in Riverside County, separates the mountain ranges of San Bernardino on the north and the San Jacinto on the south across a distance of several miles, and connects the fertile San Bernardino Valley with the sandy, desert-like Coahuilla Valley on the east. It comprises a central valley or cañon, known as San Timoteo Cañon, which varies in width from one half to a couple of miles, a high mesa or plateau which rises five hundred or more feet above the valley on the north, a belt of broken foothills lying at the foot of the San Bernardino mountain range and rising above the mesa, and another belt separating the San Timoteo Cañon from the San Jacinto range. The accompanying engraving (Plate 3) is of a photograph taken from Smiley's Heights, south of Redlands, looking eastward toward the San Jacinto Mountains. The central San Timoteo Cañon, the foothills on the south, and the broad mesa on the north are seen. The snow-capped mountains in the distance were not made visible in the engraving.

San Gorgonio Creek, near the summit of the cañon, and giving its name to the pass, rises in the mountains on the north, flows southward to near Banning and thence eastward, where it is lost in the sands of the desert; it is a running stream however only in the early spring, when the melting snows of the mountains give it a supply of water. That at some time it has been torrential in its volume and velocity is shown in the great mass of cobblestones and bowlders that mark its course down the cañon into the desert. From its mouth southeastward this deposit is so coarse and devoid of soil that it may be said that the desert lands in reality begin here, for it has spread itself across the valley and down the sloping plain toward Cabazon and Indio with a fall of 2337 feet. There are no cultivated lands in the cañon east of Banning, with the exception of about fifty acres at Cabazon and perhaps other very small patches, in other places.

The San Gorgonio Creek not only marks the descent into the desert lands, but the eastern terminus of the red mesas that reach from near Redlands in this direction along the northern side of the pass.

San Timoteo Cañon or Valley.—San Timoteo Cañon is the real gateway between San Bernardino Valley on the west and the desert of the east, and is utilized by the Southern Pacific Railroad for its Sunset route. It varies in width from a mile or more at Redlands Junction to but a few hundred yards at other points, and its course is circuitous.

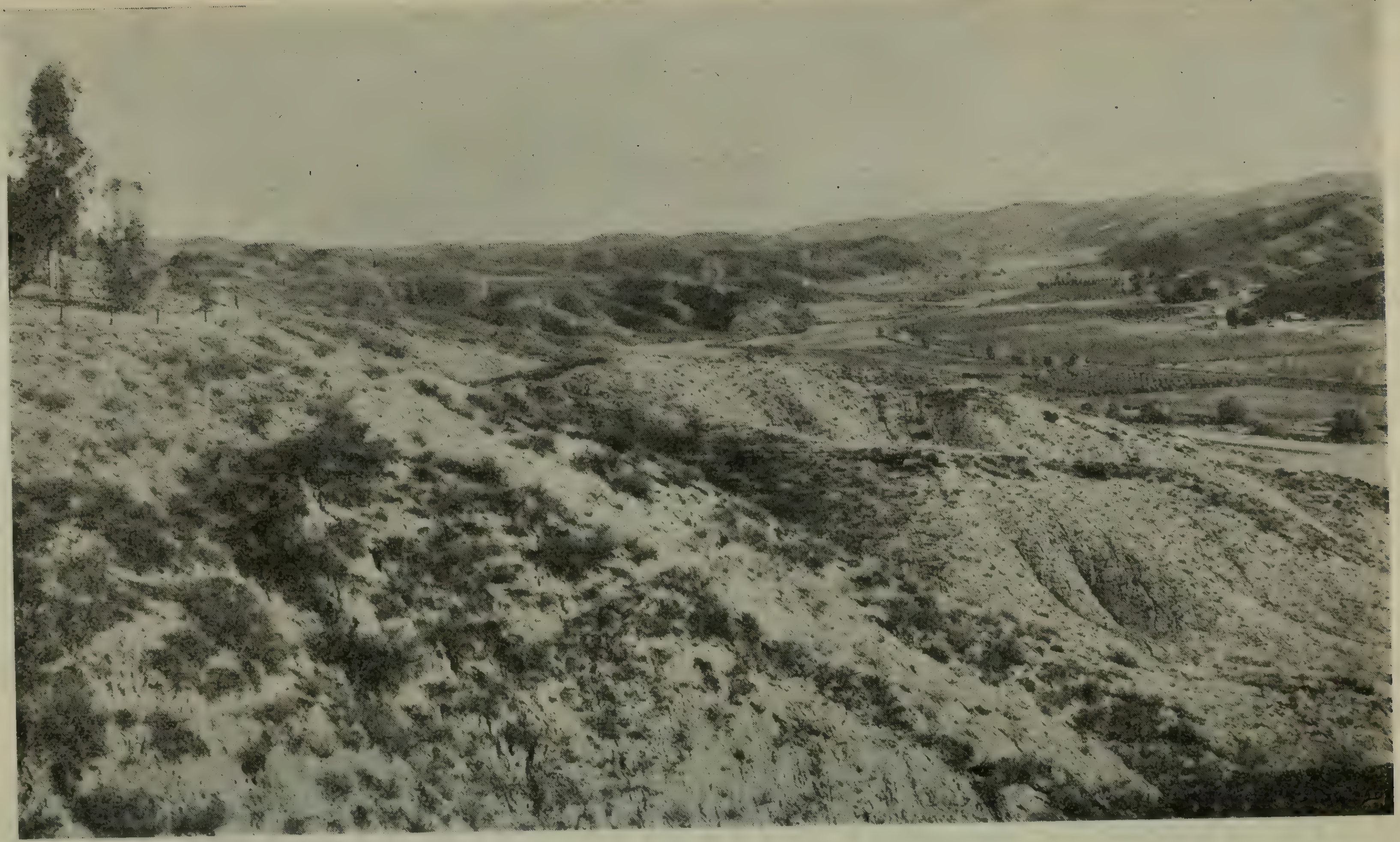


PLATE 3. San Timoteo Cañon or Valley, With Bordering Mesa Lands on the Left and the Foothills of San Jacinto Mountain Range on the Right.

It is bordered on the north by the mesa which presents a bold face of several hundred feet elevation, extending back to the mountains, and on the south by the foothills of the San Jacinto range. The engraving (Plate 4) is from a photograph taken from the car window of a rapidly moving train, and shows the mesa or plateau in the distance.

The elevations of the stations along the line of railroad, as kindly furnished by the office of the Southern Pacific, show a rapid rise from Colton to the summit at Beaumont, and a very rapid descent into the Coahuilla Valley from Banning. Colton, on the west, has an elevation of 965 feet above the level of the sea, or 672 feet above Los Angeles. Thence the valley of the cañon rises for 24 miles to an elevation of about 2,340 feet, or 1,375 feet above Colton, and then descends into the Salton Basin of the Colorado Desert to nearly 300 feet below the level of the sea—a fall of about 2,640 feet within 60 miles.

The valley at Banning is about two miles in width and slopes quite sharply to the south from the foot of the San Bernardino Mountains, the difference in elevation between the north and south being about 500 feet. This slope is produced by débris brought down from the mountains of the north, and consists of granitic sand, feldspar, etc., intermixed with gravel and small bowlders of porphyritic and micaceous granites, the deposit being more than 100 feet in thickness.

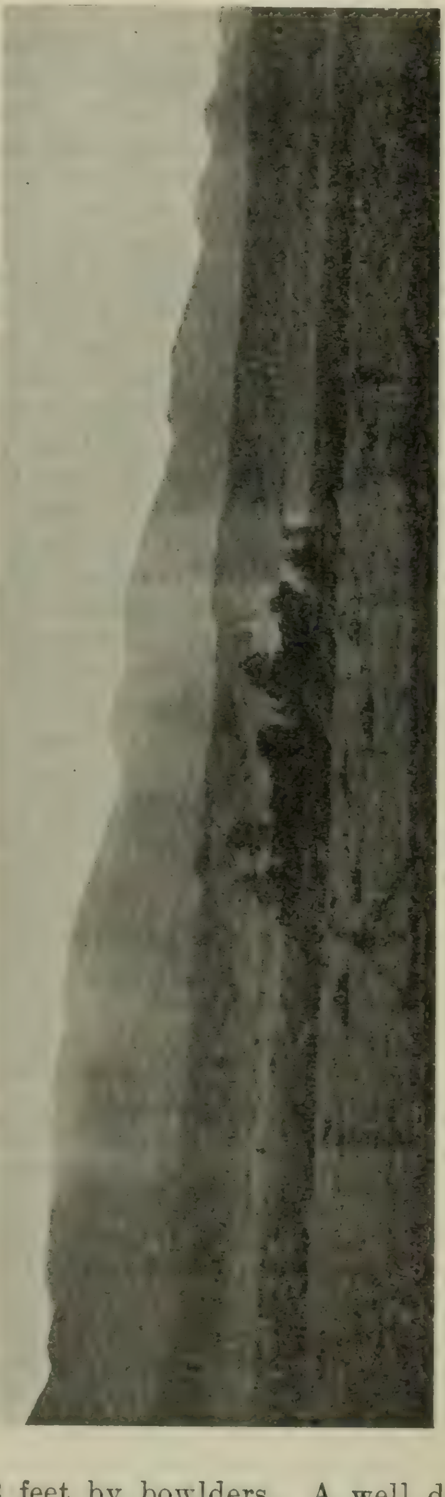


PLATE 4. Mesa or Plateau on North Side of San Timoteo Valley, with San Bernardino Mountain Range in the Background. (Photo taken from a rapidly moving train.)

The lands of this high portion of the valley are interspersed with reddish soils on knoll-like elevations, the remnants of a former mesa plateau, but otherwise they are quite sandy, and, as shown in a ravine near the town, are underlaid at a few feet by sand and gravel, and at 12 feet by bowlders. A well dug in the lower part of the trough of the valley showed a reddish gray soil and earth for 20 to 30 feet, then 10 to 20 feet of a bluish clay over about 20 feet of sand, gravel, and bowlders, in which water was found.

The soil of the valley proper is, for the most part, sandy and very rich in plant-food elements, the percentage of phosphoric acid being about .15. It is very generally under cultivation in grain, alfalfa, and orchards.

Mesa or Plateau Lands.—On the southern side of the cañon the Riverside mesa rounds to a point just east of Colton; and a little farther east, opposite Redlands Junction, there are only foothills whose slopes alone have a reddish soil. These rolling hills continue east toward Banning, and it is only now and then that any red lands are seen, the soil being mostly of a grayish color and the mesa feature being entirely absent. These hills have about the same elevation as the mesa on the opposite side, but are covered largely with a brushy growth.

On the north of the cañon and east of Colton the mesa begins with Smiley's Heights, a westerly prong of the mesa that extends as a belt along the foot of the Sierra Madre Mountains to Pasadena. This prong is narrow on the summit point, but widens as it approaches the main mesa to eastward, and is capped with a reddish soil overlying a great thickness of gray granitic débris. To the eastward the mesa narrows and is occasionally cut in two by cañons and ravines from the mountains to San Timoteo Cañon. Its elevation above the cañon floor becomes less and less, until at the summit of the pass it disappears and the valley spreads out and occupies the entire width from the San Bernardino range of mountains on the north to the San Jacinto range on the south, a distance of several miles. The town of Beaumont is situated upon this plain, and the country is generally under cultivation in grain and fruits.

Beyond this summit the mesa again appears and reaches to San Gorgonio Creek; this is the eastern limit of the mesa, for just to the east and beyond the creek the low hills are broken and rough and form an offshoot from the foothills of the mountains. They are said to be mineral-bearing.

The town of Banning is situated at this point, above which the mesa rises some 500 feet and presents quite a steep face to the valley.

These mesas are built up of the whitish disintegrated material of granite and associated rocks, and are usually capped with a reddish, gravelly loam soil 8 or 10 feet in thickness. They are separated from the mountain range by a series of sharp and rugged hills of solid granitic rocks.

To the north of Banning there are two mesa levels, one having an elevation of more than 500 feet above the town, and the other rising about 50 feet still higher. It is only about one half mile long and one eighth mile wide, and on its northern side is bordered by sharp peaks of disintegrating granite in bowlder-like masses. In each the character of the material is the same.

The lower mesa is about one mile in width and four miles long in a northerly course before being cut by cañons from the mountains. It is made of great beds of granitic débris, and capped with a reddish loamy soil; its rather level surface being devoted to grain culture.

These mesas extend northwestward toward Redlands, east of which city they break off, one portion following the foot of the mountains on the north side of the valley, with interruptions, to Pasadena; the other prong, on which rests Smiley's Heights, as already mentioned, reaches westward and narrows to a point, and descends to the level of the valley near Redlands Junction, at the mouth of San Timoteo Cañon.

Smiley's Heights was doubtless once the northern front of the plateau which reaches southward (on which rests East Highlands and Riverside), before being cut in two by the erosion that produced San Timoteo Cañon.

Redlands thus nestles in the broad cove bordered on the south, east, and north by the mesa which marks the eastern end of the valley of Southern California.

Samples of the soils of the main mesa near Banning were taken in the winter of 1900 for examination, and the result is shown in the following:

No. 2234. *High mesa soil*, bordering the San Gorgonio Pass north of Banning, Riverside County. Mr. C. O. Barker says this soil produces about two tons of barley per acre.

The analysis was made by Mr. E. H. Lea, a graduate student in the laboratory.

No. 2234. CHEMICAL ANALYSIS OF SAN GORGONIO MESA SOIL.

		Per Cent.
Coarse materials > 0.5mm		17.45
Fine earth		82.55
Analysis of Fine Earth.		
Insoluble matter	57.57	72.05
Soluble silica	14.48	
Potash (K_2O)		1.00
Soda (Na_2O)		.15
Lime (CaO)		1.50
Magnesia (MgO)		1.64
Br. ox. of manganese (Mn_3O_4)		.02
Peroxid of iron (Fe_2O_3)		8.24
Alumina (Al_2O_3)		8.62
Phosphoric acid (P_2O_5)		.16
Sulfuric acid (SO_3)		.01
Water and organic matter		6.03
Total		99.42
Humus		1.0
Humus ash		.56
Available potash	citric	.01
Available phosphoric acid	method	.02
Hygroscopic moisture (absorbed at 14° C.)		6.46

The analysis shows this mesa soil to be very rich in potash, probably derived from the disintegration of the feldspathic granites of the region. The percentages of lime and magnesia are also very good, while that of phosphoric acid is above the average of California soils. The amount of humus is also ample.

This soil in all of its features bears a close resemblance to the red mesa lands of East Highlands on the north and of Riverside on the south, as well as to those of Perris on the southwest of the San Jacinto Mountains. This is specially true with respect to the percentages of the chief food elements, viz., potash, lime, magnesia, and phosphoric acid, as shown in the following table:

	Potash.	Lime.	Magnesia.	Phosphoric Acid.	Humus.
Banning	1.00	1.50	1.64	0.16	1.00
East Highlands	.98	.96	1.42	.13	.58
Riverside	.87	1.57	1.33	.14	1.99
Corona	1.17	1.19	1.29	.11	.64

In all of these lands of the red mesas from East Highlands to Corona, and doubtless elsewhere on this belt, the amounts of potash, lime, magnesia, and phosphoric acid are high, and fertilization will or should not be needed for many years to come. The soils of Banning and Riverside are also rich in humus, but those of East Highlands and Corona seem to be near the point where green-manuring will soon be needed to replenish the supply.

SOILS RECEIVED FOR EXAMINATION.

The following list gives the names of the persons who have sent soils to this Station for examination, either for the purpose of ascertaining whether or not fertilization was needed, or whether an injurious amount of alkali salts was present. The samples were duly examined and the results sent to the parties interested:

Foothill Region.

Name.	Locality.	County.	Sender.
Soils (16)	Wheatland	Yuba	R. N. Durst
Red clay	Oroville	Butte	
Soils (6)	Wyandotte	Butte	G. W. Miller
Soils (4)	Thermalito	Butte	W. E. Vaughn
Black loams (2)	Beckwith	Plumas	C. F. Gardner
Soils (5)	Marcuse	Sutter	C. S. Brooks
Red subsoil	Lincoln	Placer	L. C. Sage
Red clay	Colfax	Placer	Dr. Peers
Soils (7)	Auburn	Placer	R. C. Williamson
Soils	Rocklin	Placer	J. F. Garner
Clay loams	Fall River Valley	Shasta	John McArthur
Dark soils (3)	Cedarville	Modoc	D. T. Fowler
Volcanic soils (4)	Placerville	El Dorado	S. L. Turner
Soils (3)	Placerville	El Dorado	Thomas Harris
Soil	Ione	Amador	C. W. McMurray

Coast Range Region.

Name.	Locality.	County.	Sender.
Soils (2)	Ferndale	Humboldt	Mrs. H. E. Van Winkle
Soil	Happy Valley	Shasta	O. K. Smith
Soils (4)	Napa	Napa	F. Forbes
Infusorial earth	Napa	Napa	A. W. Robinson
Black loam	Rutherford	Napa	W. E. Stevens
Soils (3)	Rector	Napa	H. W. Taber
White clay and sand	St. Helena	Napa	Geo. Schmidt
Dark sandy soil	St. Helena	Napa	Geo. Schmidt
Clay soil	Santa Rosa	Sonoma	Water Works Co.
Alluvial soils (9)	Petaluma	Sonoma	— Leichtenberg
Loam soil	Petaluma	Sonoma	C. Nisson
Soils (2)	Healdsburg	Sonoma	C. Reddinger
Loams (3)			A. Bull & Co.
Black clay	Healdsburg	Sonoma	Mrs. C. Redding
Dark loams	Healdsburg	Sonoma	Mrs. C. Redding
Red soil	Sonoma	Sonoma	David Dazell

Coast Range Region—Continued.

Name.	Locality.	County.	Sender.
Soils (2)	Santa Rosa	Sonoma	Merritt Fruit Co.
Soil	Santa Rosa	Sonoma	Mrs. E. Woodhouse
Soils (5)	Sonoma	Sonoma	E. T. Allen
Soils (4)	Santa Rosa	Sonoma	N. S. Turley
Soils (3)	Mendocino City	Mendocino	J. B. Davy
Loams (3)	San Rafael	Marin	D. F. Cornwall
Soils (3)	Novato	Marin	A. D. Hatch
Black adobe		Lake	A. Rocca
Soils (5)	Danville	Contra Costa	J. O. Stewart
Clay soil	Martinez	Contra Costa	R. L. Ulsh
Soils (3)	Antioch	Contra Costa	T. L. Emerson
Soils (2)	Olinda	Contra Costa	John Lamiman & Son
Soils (2)	San Lorenzo	Alameda	W. E. Meek
Island soil	Bay Farm Island	Alameda	J. O. Titlow
Soils (6)	Centerville	Alameda	A. H. Powers
Dark clays (5)	Haywards	Alameda	J. B. Parsons
Sedimentary clay	Livermore	Alameda	J. Carneal
Soils	Niles	Alameda	J. C. Shinn
Soils (3)	Newark	Alameda	T. G. Kirkland
Red soil	San Lorenzo	Alameda	W. E. Weeks
Black soil	Alameda	Alameda	J. C. Siegfried
Soils (2)	Niles	Alameda	J. C. Shinn
Soil	San Lorenzo	Alameda	H. W. Weeks
Red loam soil	San Francisco	San Francisco	Dr. H. Wagner
Soil	San Francisco	San Francisco	D. C. Houghton
Sandy soils (15)	San Francisco	San Francisco	J'dge A. W. Thompson
Soils (6)	San Francisco	San Francisco	Dr. Geo. W. Leek
Marsh clay	San Mateo	San Mateo	Mrs. Wm. Redding
Marsh soils	Menlo Park	San Mateo	C. R. Spivals
Dark loams (2)	Menlo Park	San Mateo	T. Hopkins
Soils (6)	Half Moon Bay	San Mateo	Ed. Schubert
Soils (8)	Campbell	Santa Clara	H. A. Craig
Soils (2)	Campbell	Santa Clara	H. B. Hall
Soil	Los Gatos	Santa Clara	A. O. E. Munkhouse
Yellow loam	Los Gatos	Santa Clara	W. A. Stidston
Clay loams	Los Gatos	Santa Clara	H. G. Osborn
Clay soils (8)	Los Gatos	Santa Clara	B. L. Bartlett
Soils (3)	Los Gatos	Santa Clara	H. C. Hodgeman
Soils (6)	Los Gatos	Santa Clara	L. A. Sabin
Soils (6)	Los Gatos	Santa Clara	Mrs. Sterling Richards
Soil	Los Gatos	Santa Clara	G. Butler
Soils (2)	Gilroy	Santa Clara	Spreckels' Ranch
Soils (12)	Gilroy	Santa Clara	H. C. Morley
Soils (6)	Gilroy	Santa Clara	H. C. Morley
Soils (3)	Gilroy	Santa Clara	George C. Ester
Calcareous soil	San José	Santa Clara	A. T. Herriam
Soils (4)	San José	Santa Clara	James Snow
Soils (2)	Campbell	Santa Clara	L. A. Newholtz
Loam	West Side	Santa Clara	R. E. Banks
Soils (7)	Los Gatos	Santa Clara	G. A. Muirson
Adobe soils (9)	Morgan Hill	Santa Clara	J. D. Bagley
Yellow clay (2)	Warm Springs	Santa Clara	Wm. Bruckman
Soils (2)	Santa Clara	Santa Clara	Walter Kenyon
Soils (2)	Palo Alto	Santa Clara	T. F. Huntington
Soils (2)	Saratoga	Santa Clara	Balfour, Guthrie & Co.
Soils (4)	Mountain View	Santa Clara	R. C. Kirkwood
Soil	Watsonville	Santa Cruz	D. A. Driscol
Soils (3)	14 miles from S. Cruz	Santa Cruz	A. N. Van Fleet
Soil	Skyland	Santa Cruz	Gerrard Wightman
Soil	San Juan Bautista	San Benito	Canfield Bros.
Soils (3)	San Juan	San Benito	Mrs. J. F. Breen
Soils (2)	Hollister	San Benito	J. B. Evans
Soils (4)	Arroyo Grande	San Luis Obispo	L. C. Bell

Great Valley Region.

Name.	Locality.	County.	Sender.
Sandy soil	Redding	Shasta	O. K. Smith
Surface soil	Redding	Shasta	Mrs. Bassett
Soils (3)	Corning	Tehama	Mr. Lane
Soils (3)	Corning	Tehama	Mrs. C. H. Stevens
Soils (23)	Corning	Tehama	F. J. Snow
Gravelly clays (12)	Kirkwood	Tehama	W. Hollis
Sandy soil	Fruto	Glenn	G. F. Gardner
Soils (2)	Fruto	Glenn	S. Blum
Soil	Chico	Butte	C. C. Royce
Soils (2)	Biggs	Butte	Jas. Snow
Yellow clay soil	Colusa	Colusa	A. Rodgers
Gravelly loam	Colusa	Colusa	J. B. de Jarnatt & Son
Soils (2)	Wheatland	Yuba	M. Horst
Soils (5)	Marysville	Yuba	C. S. Brooks
Soils (7)	Yuba City	Sutter	Miss E. Wilbur
Soils (2)	Yuba City	Sutter	R. C. Kells
Alluvial soil	Davisville	Yolo	H. M. La Rue & Sons
Alkali soil	Woodland	Yolo	G. H. Hecke
Soils (4)	Vacaville	Solano	Mrs. E. P. Buckingham
Red soil	Sacramento	Sacramento	W. E. Vaughan
Soil	Sacramento	Sacramento	Truman Reeves
Soils (4)	Pomelo	Sacramento	Isaac Lester
Soils (4)	Galt	Sacramento	Whittaker & Ray
Sandy loams (4)	Woodbridge	San Joaquin	A. A. McClelland
Soils (3)	Stockton	San Joaquin	Miss J. Williams
Soils (3)	Stockton	San Joaquin	E. G. Williams
Soil	Lathrop	San Joaquin	Burkhard & Batterman
Sandy soils (39)	Modesto	Stanislaus	J. M. Heron
Soils (9)	Modesto	Stanislaus	F. A. Cressey
Soils (5)	Modesto	Stanislaus	Geo. Marchbank
Soils (2)	Turlock	Stanislaus	N. H. Lamont
Earths (4)	Modesto	Stanislaus	N. E. Leek
Soil	Atwater	Merced	J. F. Peters
Soils (2)	Merced	Merced	N. H. Lamont
Soil	Madera	Madera	T. Cogswell
Soils (2)	Reedley	Fresno	J. M. Briar
Soil	Fresno	Fresno	G. W. Dowda
Soils (2)	Fresno	Fresno	B. D. Maxson
Soil	Fresno	Fresno	C. E. Marshall
Soils (4)	Fresno	Fresno	A. B. Williams
Soils (2)	Fresno	Fresno	Col. Forsyth
Soils (31)	Fresno	Fresno	Judge Wallace
Vineyard soils (6)	Fresno	Fresno	H. Geselman
Soils	Fresno	Fresno	H. Geselman
Sandy soils (2)	Fresno	Fresno	Gordon Bros
Soils (4)	Fresno	Fresno	W. N. Rohrer
Micaceous soils	Fresno	Fresno	H. G. Dewitt
Soil	Selma	Fresno	W. E. Walker
Clay	Selma	Fresno	L. M. Miller
Soil	Selma	Fresno	J. McClurg
Soils (12)	Selma	Fresno	H. T. Unger
Adobe soil	Easton	Fresno	D. N. Smith
Sandy soils (4)	Selma	Fresno	J. G. Blumer
Soil	Selma	Fresno	J. A. McClurg
Soil	Oleander	Fresno	A. Towgood
Soils (2)	Hanford	Kings	S. Brown
Alkali soils (5)	Hanford	Kings	N. W. Motheral
Gray soils (2)	Tulare (Lake)	Tulare	G. E. Bates
Red soil	Dinuba	Tulare	C. F. Collins
Loam soils (2)	Lindsay	Tulare	C. B. Fair
Alkali soils (3)	Tulare (near Lake)	Tulare	J. W. Brown
Soils (4)	Porterville	Tulare	P. J. Perry
Soils (5)	Tulare	Tulare	S. Richardson
Black loam (5)	Exeter	Tulare	R. Wood
Soils (2)	Porterville	Tulare	J. T. Bearss
Yellow soils (3)	Rosamond	Kern	M. R. Lyle
Soils (3)	Kern	Kern	J. D. Henderson
Earths (4)	Bakersfield	Kern	J. H. Van Keith
Soil	Bakersfield	Kern	D. H. Blood

Southern California.

Name.	Locality.	County.	Sender.
Soils (3)	National City	San Diego	W. A. Jones
Sandy soil	Coronado	San Diego	S. W. Koeppen
Soil	Otay	San Diego	S. W. Koeppen
Soils (2)	San Diego	San Diego	R. S. Pearse
Clay	San Diego	San Diego	Boyd & Stahl
Soils (3)	San Diego	San Diego	T. C. Stockton
Red sandy soil	National City	San Diego	F. Gardner
Soils (3)	Alpine	San Diego	H. S. Foss
Soil	Escondido	San Diego	F. Austin
Earths (2)	Palo	San Diego	M. M. Siekler
Sandy soil	Point Loma	San Diego	H. Johnson
Soils (3)	New River	San Diego	J. M. Howard
Soils (2)	Corona	Riverside	F. A. Frazer
Soil	Lake View	Riverside	Horton Carr
Soil	Elsinore	Riverside	L. S. Mason
Brown clays (2)	Riverside	Riverside	H. C. Frare
Garden mold	Riverside	Riverside	Chase Nursery Co.
Soils (3)	Riverside	Riverside	Francis Cuttle
Soils (4)	Riverside	Riverside	F. M. Borden
Soil	Riverside	Riverside	F. A. Miller
Soil	Perris	Riverside	Hook Bros.
Soils (4)	Perris	Riverside	F. Chandler
Soils (4)	Perris	Riverside	Wm. Chamberlain
Soil	Moreno	Riverside	John Cooper
Soil	San Jacinto	Riverside	Erwin Hirshfeldt
Soils (2)	San Bernardino	San Bernardino	F. W. Gregg
Soils (2)	Cucamonga	San Bernardino	John Maddock
Soils (3)	Highland	San Bernardino	F. H. Cole
Sandy loams (12)	Ontario	San Bernardino	G. W. Smith
Soils (3)	Patton	San Bernardino	G. W. Devine
Soils (12)	Highland	San Bernardino	H. I. Randall
Soils (3)	Redlands	San Bernardino	C. M. Baxter
Sandy soil	Redlands	San Bernardino	C. H. Lathrop
Soil	Bloomington	San Bernardino	E. O. Stonsell
Sandy soils (4)	Rialto	San Bernardino	D. B. Bailey
Soil	Los Angeles	Los Angeles	J. G. Warren
Soil	Los Angeles	Los Angeles	J. S. Vallely
Soils (3)	Los Angeles	Los Angeles	Dr. Jos. Kurtz
Light loams	Los Angeles	Los Angeles	Carroll Fowler
Soil	Los Angeles	Los Angeles	Nathan Cole
Soils (30)	Los Angeles	Los Angeles	R. G. Lunt
Soil	Los Angeles	Los Angeles	W. C. Petchner
Soils (2)	Los Angeles	Los Angeles	Hamilton Johnson
Sandy soil	Long Beach	Los Angeles	C. W. Marsh
Loam	Colegrove	Los Angeles	S. Gardiner
Micaceous soils	Pasadena	Los Angeles	Mrs. A. Johnston
Sandy soils (2)	La Mirada	Los Angeles	S. H. Donce
Soils (2)	Sierra Madre	Los Angeles	J. G. Blumer
Soils (3)	Monrovia	Los Angeles	W. P. Davis
Soils (3)	Lamanda	Los Angeles	H. E. Allen
Soils (16)	Manzana	Los Angeles	Manzana Colony
Muck	Pomona	Los Angeles	James Loney
Soils (4)	Lamanda	Los Angeles	N. Dolge
Soils (8)	Pomona	Los Angeles	J. W. Mills
Soils (4)	Dundee	Los Angeles	A. Van de Soorberg
Soil	Norwalk	Los Angeles	Mrs. F. McKusick
Soils (8)	Charter Oak	Los Angeles	A. Bowring
Soils (20)	La Mirada	Los Angeles	Louis Blatz
Soils (13)	Pomona	Los Angeles	H. L. Armstrong
Soil	Palms	Los Angeles	J. M. Coyner
Alkali soils (6)	Hynes	Los Angeles	J. D. Fredericks
Soil	Pomona	Los Angeles	Elias Finck
Soils (3)	Santa Maria	Santa Barbara	Rev. G. T. Weaver
Clay soils (2)	Carpenteria	Santa Barbara	J. W. Anderson
Soil	Santa Barbara	Santa Barbara	H. Dutard
Soils (6)	Santa Maria	Santa Barbara	G. E. Perkins
Black clays (6)	Santa Barbara	Santa Barbara	H. Dutard
Soils (8)	Santa Maria	Santa Barbara	Geo. E. Perkins
Adobe soil	Santa Barbara	Santa Barbara	J. S. Hawley
Soils (3)	Casmalia	Santa Barbara	P. A. K.

Southern California—Continued.

Name.	Locality.	County.	Sender.
Soil	Goleta	Santa Barbara	H. Longman
Calcareous loam	Hueneme	Ventura	Chas. Johnson
Soils (5)	Sespe	Ventura	G. Goodrich
Soil	El Rio	Ventura	J. E. Banchard
Green calcareous earth	West Saticoy	Ventura	Theo. A. Kelsey
Soils (4)	Fillmore	Ventura	C. C. Elkins
Soil	Saticoy	Ventura	C. T. Edwards
Soil	Orange	Orange	T. E. Mott
Soils (8)	Santa Ana	Orange	M. C. Cole
Soil	Fullerton	Orange	L. B. Benchley
Soil	Escondido	Orange	J. L. Dickson
Soil	Ballarat	Inyo	W. E. Porter

Outside of California.

Name.	Locality.	County.	Sender.
Surface soil	Long Branch	Pierce (Wash.)	H. T. Yzell
Soils, loamy (2)	Salem	Marion (Oregon)	J. M. Wallace
Soil	Salem	Marion (Oregon)	J. M. Wallace
Soils (3)	Eugene	Lane (Oregon)	J. O. Rhinehardt

MINERALS, ROCKS, ETC., RECEIVED FOR IDENTIFICATION.

Article.	Locality.	County.	Sender.
Infusorial earth	Carbon	Shasta	J. W. Brown
Fibrous talc	Eureka	Humboldt	
Rock	Hollister	San Benito	J. J. Croxon
Sandstone and shale	San Juan	San Benito	
Chlorite	San Miguel	San Luis Obispo	A. F. Benton
Quartz sand, cemented with iron	Camanche	Calaveras	Geo. H. Suhren
Small specimens	Wallace	Calaveras	Geo. H. Suhren
Calcareous sandstone	Navarro	Mendocino	R. A. Smith
Tea-kettle deposit	Hopland	Mendocino	J. S. Poor
Phosphate rock	Low'r Klamath Lake	Siskiyou	F. M. Anderson
Opalized wood	Honcut	Butte	Mr. Knight
Decayed shales	Vacaville	Solano	W. J. Dobbins
Bone dust	San Rafael	Marin	B. Brennfleck
Lime carbonate	Santa Barbara	Santa Barbara	Crocker, Sperry & Co.
Claystone and calcite	Santa Barbara	Santa Barbara	Hunt & Haywood
Chalk	Bakersfield	Kern	L. A. Metcalf
Claystones (2)	Bakersfield	Kern	George R. Wilson
Alum and talc	Bakersfield	Kern	J. S. Drury
Talc	Tulare	Tulare	S. R. Cain
Gypsum	(Exp. Sta.) Tulare	Tulare	C. H. Shinn
Shell marl	Fresno	Fresno	G. W. Dowda
Gypsum	Fresno	Fresno	Bucter Vineyard
White deposit	West of Selma	Fresno	J. E. Roadnouse
Pinkish rock	St. Helena	Napa	George Schmidt
Volcanic ash	Santa Rosa	Sonoma	L. Burbank
Chlorite	Healdsburg	Sonoma	C. Strehlow
Yellow ochre and gypseous clay	Tulare	Tulare	S. Richardson
Quartz and serpentine	Petaluma	Sonoma	C. Nisson
Marl and sand		Contra Costa	S. Poorman
Limestone	Concord	Contra Costa	O. H. Jones
Micaceous sand	Concord	Contra Costa	C. W. Klein
Peat	Oakland	Alameda	T. T. Frickstad
Sandstone	Berkeley	Alameda	S. H. Warrian

Minerals, Rocks, Etc.—Continued.

Article.	Locality.	County.	Sender.
Peat (5)	San Francisco	San Francisco	Griffin, Skelley & Co.
White rock	San Francisco	San Francisco	James E. Fowler
Gypsum	San Francisco	San Francisco	J. F. Uhlhorn
Green chert	San Francisco	San Francisco	J. Heyman
Peat	San Mateo	San Mateo	Mrs. Wm. Redding
Rock	Los Gatos	Santa Clara	J. G. Hawkins
Clay sediment	Campbell	Santa Clara	H. A. Craig
Rock	Watsonville	Santa Cruz	C. K. Ereanhack
Asphalt	Santa Cruz	Santa Cruz	General Bunting
Rock fragments	Los Angeles	Los Angeles	Wm. C. Petchner
White marl	Los Angeles	Los Angeles	
Serpentine	Los Angeles	Los Angeles	N. O. Cooper
White rock	Pasadena	Los Angeles	D. G. Baker
Gypseous marls(2), claystone, gypsum	Glendora	Los Angeles	W. B. Cullen
Marls (2)	San Diego	San Diego	W. M. Sheldon
Marl, clay, gypsum	San Diego	San Diego	D. Hitchcock
Sandstone	San Diego	San Diego	G. P. Hall
Talc		San Diego	F. W. Kee
White marl	Miramar	San Diego	E. M. Westbrook
Gypsum	National City	San Diego	E. A. Hornbeck
Sweetwater sediment	Chula Vista	San Diego	G. P. Hall
Sandstone	Corona	Riverside	J. A. Fraser
Rock	Corona	Riverside	L. F. Miller
Calcite	Perris	Riverside	M. Miller
Selenite	Corona	Riverside	Stand. Fertilizer Co.
Fertilizer	Bloomington	San Bernardino	E. O. Stansell
White claystone	Daggett	San Bernardino	Geo. B. Knight
Lime carbonate	McPherson	Orange	Perkins & McPherson
Alum, etc.	Orange	Orange	F. E. Mott
Rock	Santa Ana	Orange	Mrs. G. S. Manchester
Sulfate of alumina	Santa Ana	Orange	H. K. Kellogg
Infusorial earth	Santa Ana	Orange	A. J. Smith
Lignite	Santa Paula	Ventura	S. R. Jenkins
Rock fragment	Santa Paula	Ventura	S. R. Jenkins
Claystone	Santa Paula	Ventura	S. R. Jenkins
Graphitic soapstone	Santa Paula	Ventura	S. R. Jenkins
Decayed rock	West Saticoy	Ventura	Henry Kelsey
Mineral powders (4)	Simi	Ventura	C. G. Austin

ALKALI AND ALKALI LAND.

By R. H. Loughridge.

ELSINORE VALLEY.

Elsinore Valley lies in an east and west course, bordered by the Santa Ana range of mountains on the south and a lower range on the north through which a narrow pass connects it with San Jacinto Valley. The valley has a length of about fourteen miles and an average width of three or four miles; it rises somewhat in elevation toward Temecula on the east, and that upper part is a good grazing country, with scattering grain fields and orchards. The lower part of the valley is largely occupied by Lake Elsinore, having a length of about four and a width of two miles, its maximum depth being about twenty feet. The water is highly alkaline, containing, according to season, from 80 to upward of 100 grains per gallon, and is therefore utterly unfit for irrigation purposes for any length of time, as a soil of close texture would in three or four years become too highly charged with salts to permit full growth and productiveness of many kinds of orchard trees and smaller cultures. With soils that can be easily leached through natural underdrainage this accumulation could be avoided by occasionally removing the alkali by excessive application of the water.

Irrigation in the valley, whenever done, is from wells only. Hot springs occur about the town, and a well bored to a depth of 105 feet sends up water having a temperature of 130° Fahr. and is used in the bath-houses. There is also a well 126 feet deep which has cold sulphur water. Granite underlies the valley at that depth.

The composition of these spring waters is shown in the following analyses of samples taken from the bath-houses and sent by Mr. Traphagan, the proprietor of the hotel and baths:

	Sulphur Springs	Hot Springs.
	Grains per Gallon.	
Total residue by evaporation	19.40	19.82
Soluble in water after evaporation	11.83	13.12
Insoluble in water after evaporation	5.24	3.79
Organic matter and chemically combined water	2.33	2.91
The soluble part consists of—		
Sodium and potassium sulfates (glauber salt, etc.)	4.09	7.07
Sodium chlorid (common salt)	5.07	3.38
Sodium carbonate (sal soda)	2.67	2.67
The insoluble part consists of—		
Calcium and magnesium carbonates	2.33	1.92
Silica	2.91	1.87

Lands Along the Border of Lake Elsinore.—The waters of the lake have been slowly evaporating during the past years, and now there is along the immediate border a crust of alkali salts. Back from this the land is less charged with alkali, and here and there orchards have been planted and grown, especially on the west side. There are, however, in the cultivated region spots that are still bare of vegetation, because of the very large content of salts.

The analysis of soil from one of these, five or six acres in extent, is given below, the total salts in thirty inches depth being at the rate of about 117,000 pounds per acre. On this spot an apricot orchard was originally planted, but the rise of alkali killed the trees. A pear orchard on Mr. Eben Clewett's place, a little nearer the lake, was found to be in fair condition, while quinces on the same soil were stunted. The lake water is said to percolate beneath this land and rises to within three feet of the surface at times. The examination of the soils shows the presence of a large amount of alkali salts, the composition being given below.

Bur-clover was found growing luxuriantly in an alkali soil near the bath-house of the hotel, the soil being wetted by water from the baths. Samples of the soil in the clover spot were examined, with results given below.

ALKALI SALTS IN SOILS BORDERING LAKE ELSINORE.

Depth Taken.	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Salts	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Alkali
Bare spot.								
12 inches	1.527	.017	.166	1.710	61,080	680	6,640	68,400
12–30 inches	.739	.013	.056	.808	44,340	780	3,360	48,480
Total	1.054	.014	.100	1.168	105,420	1,460	10,000	116,880
Pear orchard; trees in fair condition.								
36 inches	.986	.011	.023	1.020	118,320	1,320	2,760	122,400
Quince tree; stunted in growth.								
36 inches	.581	.006	.111	.698	69,800	680	13,360	83,840
Bur-clover; luxuriant growth.								
10 inches	.027	.017	--------	.044	900	570	--------	1,470
10–20 inches	.106	.170	--------	.276	3,540	5,660	--------	9,200
20–30 inches	.039	.153	--------	.192	1,300	5,100	--------	6,400
Total	--------	--------	--------	--------	5,740	11,330	--------	17,070

The amount of sulfates and of chlorid (common salt) respectively tolerated by the pear is in this case greater than heretofore observed. The results show also that the sulfates are even less harmful than had been supposed.

The dwarfing of the quince is not to be wondered at when we find so large an amount of common salt around its roots.

The tolerance of bur-clover for carbonate of soda is surprising, and can only be accounted for by its scarcity in the upper soil where its corrosive action is usually most severely felt.

ALKALI INVESTIGATIONS AT THE SUBSTATIONS.

The substation at Tulare, located as it is on alkali land, has been the scene of extended alkali study, first as to the best means of reclamation, and second as to the amount of the several salts of alkali which may be tolerated by various orchard, vineyard, and smaller crops. The partial results are embraced in the several bulletins on the subject that have been issued by the Station from time to time. The work is by no means complete, and as new results are obtained they will be reported.

The ten-acre tract of the Southern California substation at Chino is also on alkali land, but not of as severe a nature; many results have been obtained from experiments with cultures on these plots.

Sorghum in Alkali.—At the Tulare substation sorghum grows luxuriantly in soils having a large amount of alkali, the surface often having quite a black incrustation from the black alkali. The following results are from an examination of the soil, the analyses being made by Mr. Howson, a student in the laboratory:

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Salts	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Alkali
First foot	.785	.022	.065	.872	31,400	880	2,600	34,880
Second foot	.316	.114	.056	.486	12,640	4,560	2,240	19,440
Third foot	.274	.085	.065	.424	10,960	3,400	2,600	16,960
Fourth foot	.171	.025	.056	.252	6,840	1,000	2,240	10,080
Total in 4 feet	.385	.062	.061	.509	61,840	9,840	9,680	81,360

In the above soil-section the sulfates are largest in the surface foot, the carbonate in the second and third, while the chlorid (common salt) is quite evenly distributed through the four feet depth. In other spots the carbonate seems to be largely at or near the surface. Sorghum thus shows a high tolerance of alkali salts of each kind, and will grow where many other crops fail.

The Alkali Sump.—At the Tulare substation there is a natural sink or sump, into which the drainage of the grounds is conducted and into which alkali salts are being received. In this sump a well has been dug to gravel to carry off the water, and an analysis of this water shows the composition in December, 1900:

	Grains per gallon.
Sulfates of alkalies	20.15
Sodium chlorid (common salt)	8.30
Sodium carbonate (sal soda)	7.40
Calcium sulfate (gypsum)	20.41
Total mineral salts	56.56

EFFECT OF DROUTH ON THE RISE OF ALKALI SALTS AT THE SOUTHERN CALIFORNIA SUBSTATION.

The ten-acre tract of the Southern California substation, located near Chino, is divided into 169 plots, and culture experiments have been carried on to test the effect of alkali upon the growth of plants. In 1895 samples of the surface foot of soil were taken from alternate plots throughout the tract and their content of alkali salts determined, the results being given in the Annual Report for 1894–5. These results showed that the greater part of the alkali was held by the soils of the northern end of the tract, and that a few of the plots contained quite a large amount, plots 7 and 53 for instance having as much as 11,000 pounds in the upper foot.

The season of 1894, when these samples were taken, was a comparatively wet one, and the alkali salts were doubtless largely washed down to a lower depth than when taken in the sample; although examinations made on plots 5, 9, and 74 showed that the first foot there contained practically all the salts.

The seasons of 1898, 1899, and 1900 have been dry ones, and the increase of alkali in the surface soil had become quite evident. It was therefore determined to again examine the soil of several of the plots to see to what extent alkali had risen from below.

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates	Carbonate	Chlorid	Total	Alkaline Sulfates (Glauber Salt)	Carbonate (Sal Soda)	Chlorid (Common Salt)	Total Alkali
Plot 7.								
1894—First foot	.223	.035	.023	.281	8,920	1,400	920	11,240
1901—First foot	.428	.008	.037	.473	17,120	320	1,480	18,920
Second foot	.032	.015	.005	.052	1,280	600	200	2,080
Third foot	.005	.012	.003	.020	200	480	120	800
Total	.155	.012	.015	.182	18,600	1,400	1,800	21,800
Plot 53.								
1894—First foot	.189	.050	.038	.277	7,560	2,000	1,520	11,080
1901—First foot	.273	.010	.009	.292	10,920	400	360	11,680
Second foot	.010	.019	.003	.032	400	760	120	1,280
Third foot	.038	.003	.009	.050	1,520	120	360	2,000
Total	.107	.011	.007	.125	12,840	1,280	840	14,960
Plot 87.								
1894—First foot	.022	.038	......	.060	880	1,520	....	2,400
1901—First foot	.035	.022	.009	.066	1,420	880	360	2,640
Second foot	.037	.010	.006	.053	1,480	400	240	2,120
Third foot	.020	.011	.005	.036	800	440	200	1,440
Total	.031	.014	.007	.052	3,700	1,720	800	6,200
Plot 136.								
1894—First foot	.024	.023	.005	.052	960	920	200	2,080
1901—First foot	.301	.017	.020	.338	12,040	680	800	13,520
Second foot	.005	.014	.003	.022	200	560	120	880
Third foot	.007	.010	.005	.022	280	400	200	880
Total	.104	.014	.009	.127	12,520	1,640	1,120	15,280

It will be seen from the table that in each case the sulfates and total alkali salts have greatly increased in the surface foot. The sulfates had in each of the plots, except 87, almost entirely risen to the surface, the movement upward being facilitated, as Professor Hilgard suggests, by their tendency to form long needle-like crystals. In plot 87 the sulfates were quite evenly distributed through the three feet examined.

The carbonate was in larger amount in the surface foot in 1894 than in 1901, and the same is true with regard to the common salt on plot 53. While, therefore, the sulfates have moved up rapidly, the carbonate has been retarded in its movement, much of it still remaining below the surface foot; and the common salt has been very erratic, coming largely to the upper foot in plots 7 and 136, and remaining behind in plots 53 and 87.

The results emphasize the fact that several salts of alkali are independent of each other in their movements in the soil, and that each may concentrate itself at some one point at one season and at another point the next season; and that these changes in the relative composition of alkali in the soil may take place at any time of the year when affected by seasonal changes.

The results also emphasize the importance of ascertaining the total amount of alkali in the entire soil column of at least four feet, if we would rightly judge of the effect of the salts on plant growth.

EXAMINATION OF SAMPLES SENT TO THE STATION.

Alkali soils from G. H. Hecke, Woodland, Yolo County. The samples are from the garden of the Jackson ranch, a few miles from town, which has been irrigated with water from the well for nine years past; the alkali appears on clods that have become dry. The water is from a well 70 feet deep, and contains 27 grains of soluble salts per gallon, of which 7 are carbonate of soda.

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Salts	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Alkali
First foot	.166	.008	.037	.212	6,680	320	1,480	8,480
Second foot	.278	.006	.023	.307	11,120	240	920	12,280
Total	.223	.007	.030	.259	17,800	560	2,400	20,760

The amount of alkali in this soil is rather large for land from that section of the State, and is doubtless due to the long use of the irrigation water, from which the salts have been accumulated.

Saline soil from reclaimed land on Petaluma Creek near Reclamation, Sonoma County; sent by Mrs. Fannie W. Redding, Berkshire, Mass.

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates..	Carbonate of Soda...	Chlorid of Sodium ..	Total Salts.	Alkaline Sulfates..	Carbonate of Soda...	Chlorid of Sodium ..	Total Alkali....
Marsh clay	.054	--------	.038	.092	2,160	--------	1,520	3,680
Sediment above peat	.455	--------	.225	.680	18,200	--------	9,000	27,200

The marsh clay does not contain an injurious amount of alkali salts, but the sediment is too highly charged with it, and especially with common salt, to permit the growth of most cultures.

Reclaimed saline land, south end of San Francisco Bay; sent by Dumbarton Land Company, San Francisco.

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates ..	Carbonate of Soda...	Chlorid of Sodium ..	Total Salts .	Alkaline Sulfates ..	Carbonate of Soda...	Chlorid of Sodium ..	Total Alkali....
No. 1	.170	----	.210	.380	6,800	--------	8,400	15,200
No. 3	.280	-------	.920	1.200	11,200	--------	36,800	48,000
No. 4	.190	-------	.810	1.000	7,600	--------	32,400	40,000

These soils will have to be cleared of a very large amount of their salts before cultures of most kinds will be profitable; this is especially true of Nos. 3 and 4, in whose alkali common salt is the chief constituent.

Alkali soils from near Collinsville, Solano County; sent by T. T. Frickstadt, Oakland. Sample No. 1 was taken one fourth mile from the river; No. 2 from near a slough 300 feet from the river; No. 5 from about one half mile from the river. Good crops have been grown on Nos. 1 and 2.

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates ..	Carbonate of Soda...	Chlorid of Sodium ..	Total Salts.	Alkaline Sulfates ..	Carbonate of Soda...	Chlorid of Sodium ..	Total Alkali....
No. 1	.282	--------	.374	.656	11,280	--------	14,960	26,240
No. 2	.109	--------	.107	.216	4,360	--------	4,280	8,640
No. 3	1.016	--------	.752	1.768	40,640	--------	30,080	70,720
No. 5	.232	--------	.488	.720	9,280	--------	19,520	28,800

In each of these soils the amount of common salt is too great for most cultures; this is especially true of Nos. 1, 3, and 5. Barley would probably grow on No. 2, though this is doubtful, because the samples of soil do not represent the full four feet in depth.

Alkali soils from Sec. 7, T. 15 S., R. 15 E., south of Mendota, Fresno County; sent by I. Teilman, engineer Fresno Canal and Irrigation Company.

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates ..	Carbonate of Soda ..	Chlorid of Sodium ..	Total Salts .	Alkaline Sulfates ..	Carbonate of Soda...	Chlorid of Sodium ..	Total Alkali....
3 feet	.212	.003	.111	.326	25,440	360	13,320	39,120
3 to 6 feet	.313	.005	.186	.504	37,560	600	22,320	60,480
Total in 6 feet	.263	.004	.148	.415	63,000	960	35,640	99,600

The amount of common salt in this soil is enormous and too great for tolerance on the part of any crop. The carbonate of soda is not large. Drainage is the only remedy.

Alkali soils from Malaga, Fresno County. No. 1 was sent by J. W. Clark; No. 2 by B. Bienenfeld.

		Percentage in Soil.				Pounds per Acre.			
		Alkaline Sulfates ..	Carbonate of Soda ...	Chlorid of Sodium...	Total Salts ..	Alkaline Sulfates ..	Carbonate of Soda ...	Chlorid of Sodium ...	Total Alkali ....
No. 1.	First foot	.108	-------	.121	.229	4,320	--------	4,840	9,160
	Second foot	.144	-------	.056	.200	5,760	--------	2,240	8,000
	Total	.126	-------	.088	.214	10,080	-------	7,080	17,160
No. 2.	First foot	.284	.043	.075	.402	11,360	1,720	3,000	16,080
	Second foot	.046	.025	--------	.071	1,840	1,000	--------	2,840
	Third foot	.063	.022	--------	.085	2,520	880	--------	3,400
	Total, 3 feet	.131	.030	.025	.186	15,720	3,600	3,000	22,320
Surface crust		.527	.122	.051	.700	5,270	1,220	510	7,000

The soil No. 1 is rather strongly charged with common salt, and this would prevent its use for many cultures. Application of abundance of water and underdrainage is the only remedy by which the salt could be dissolved and washed out of the land.

The amounts of carbonate and chlorid in No. 2 are each rather high; and while the former can be neutralized by application of gypsum, the salt in the first foot might prove a serious matter for many cultures.

Alkali soils from near Tulare Lake, Tulare County; sent by George E. Bates, San Francisco. The samples are from two localities, and were in each case taken to a depth of four feet.

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Salts	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Alkali
No. 1	.609	.051	.153	.813	97,440	8,160	24,480	130,080
No. 2	.116	.085	.027	.228	18,560	13,600	4,320	36,480

There are places within the area of the old basin of Tulare Lake where alkali does not exist to a very great extent; but the above localities contain enormous amounts of carbonate and chlorid of sodium—too great to be tolerated by any crop but saltbush or other alkali-loving plants.

Alkali soils from the Jesus Maria ranch, near Lompoc, Santa Barbara County; sent by H. Dutard, San Francisco. "The ranch is situated in the eastern end of a narrow valley which opens out to the ocean, five miles distant. There are high hills on the north and south; westerly winds prevail; climate is mild and foggy. The land was originally covered with a dense growth of willows, berry vines, poison oak, etc. The soil is somewhat clayey in character, cracks when dry, is loose and porous, and easily worked. It is many feet in depth and intercalated with layers of light yellow sand. The samples were taken from the east and west ends of the tract respectively."

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Salts	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Alkali
Lot 1, west end—								
6 inches	.019	.029	.004	.052	380	580	80	1,040
6 to 24 inches	.082	.016	.006	.104	4,920	960	360	6,240
Total	.066	.019	.006	.091	5,300	1,540	440	7,280
Lot 2, west end—								
6 inches	.061	.021	.014	.096	1,220	420	280	1,920
6 to 24 inches	.060	.016	.009	.085	3,600	960	540	5,100
Total	.061	.019	.012	.091	4,820	1,390	820	7,020
Lot 1, east end—								
6 inches	.016	.042	.009	.067	320	840	180	1,340
6 to 24 inches	.013	.042	.009	.064	780	2,520	540	3,840
Total	.015	.042	.009	.066	1,100	3,360	720	5,180
Dry soil	.013	.016	.013	.042	520	640	520	1,680
Wet soil	.160	.020	.950	1.130	6,400	800	38,000	45,200
Soil No. 4	.091	--------	.001	.092	3,640	--------	40	3,680
Soil No. 5	.178	--------	.022	.200	7,120	--------	880	8,000
Soil No. 6	.126	--------	.034	.160	5,040	--------	1,360	6,400

The amount of injurious salts in lots 1 and 2 of the west end is not excessive for most cultures, unless there be a larger accumulation below the two feet examined. Lot 1 of the east end has a large amount of carbonate, but this and that of the two first lots may be neutralized by gypsum and rendered suitable for plant growth.

Of the other soils examined the common salt in the "wet" soil is enormous and but few crops can tolerate it. Saltbush will doubtless flourish in it. Subdrainage is the only remedy for this soil.

Soil from William E. Thompson, Oleander, Fresno County; from a vineyard in which the vines are supposed to be dying from the presence of alkali. The examination shows the presence of only 7,500 pounds of alkali, of which 3,400 pounds is common salt. The amount is not sufficient to produce the trouble, for grapevines have elsewhere been found to withstand as much as 45,000 pounds of alkali, including nearly 10,000 pounds of common salt.

Alkali soils from near Jamison, Fresno County; sent by George F. Otis, Selma. Two localities are represented to a depth of three feet each. The soil of one locality is loose and entirely bare of vegetation; that of the other is more firm and is covered with grass. Surface water is from 7 to 9 feet below the surface, and the soil is damp at 17 inches. The lumps of the third foot of No. 1 were filled with crystals of glauber salt (sulfate of soda).

The soils of the second and third foot of No. 2 were more clayey than in No. 1. Both sets contained some free gypsum.

		Percentage in Soil.				Pounds per Acre.			
		Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium (Common Salt)	Total Salts	Alkaline Sulfates (Glauber Salt)	Carbonate	Chlorid (Common Salt)	Total Alkali
No. 1.	First foot	.845	.006	.008	.859	33,800	240	320	34,360
	Second foot	3.741	.015	.033	3.789	149,640	600	1,320	151,560
	Third foot	3.688	.010	.032	3.325	147,520	400	1,280	149,200
	Total	2.756	.010	.024	2.790	330,960	1,240	2,920	335,120
No. 2.	First foot	.474	.006	.092	.572	18,960	240	3,680	22,880
	Second foot	2.024	.006	.018	2.048	80,860	240	720	81,820
	Third foot	2.413	.005	.074	2.492	96,520	200	2,960	99,680
	Total	1.637	.006	.061	1.704	196,340	680	7,360	204,380

The amount of alkali in each of these soils is enormous, that of sulfate or glauber salt being especially so. The carbonate of soda is not excessive; but common salt or chlorid is present in rather too large amount in No. 1, and especially excessive in No. 2.

The only method of reclamation of these soils is by washing the salts out by flooding and underdrainage.

Alkali soils from near Hanford, Kings County. The first three lots were sent by N. W. Motheral, from orchard land; prunes are said to do well on these soils, but peaches are killed by the alkali. Two other samples were received from W. S. Brown, of Hanford, each said to be an average of three feet in depth. They show a great deal more of alkali salts than the others. No. 2 must have been taken from one of the worst alkali spots of the entire region and is bare of vegetation.

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Salts	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Alkali
No. 1. Two feet	.049		.019	.068	3,920		1,520	5,440
Third foot	.031		.005	.036	1,240		200	1,440
Fourth foot	.058		.014	.072	2,320		560	2,880
Total, 4 feet	.047		.014	.061	7,480		2,280	9,760
No. 2. First foot	.066		.026	.092	2,640		1,040	3,680
Second foot	.012		.028	.040	480		1,120	1,600
Third foot	.051		.009	.060	2,040		360	2,400
Total, 3 feet	.043		.021	.064	5,160		2.525	7,680
No. 3. Two feet	.088	.002	.070	.160	3,520	80	2,800	6,400
From Mr. Brown:								
No. 1. Three feet	.451	.029	.220	.700	54,120	3,480	26,400	84,000
No. 2. Three feet	3.015	.085	1.040	4.140	361,800	10,200	124,800	496,800

Peach trees are evidently very sensitive to alkali, dying in a total of less than 10,000 pounds per acre, of which one fourth is common salt. The maximum tolerance of prunes has not been ascertained as yet, for no trees have been found whose death could be attributed to alkali.

Alkali soils from Kern City, Kern County; sent by J. D. Henderson. Olive trees have died on this land; samples of soil were taken to a depth of five feet.

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Salts	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Alkali
First foot	.068	.004	.008	.080	2,720	160	320	3,200
Second foot	.078	.016	.040	.134	3,120	640	1,600	5,360
Third foot	.388	.016	.152	.556	15,520	640	6,080	22,240
Fourth foot	384	.008	.288	.680	15,360	320	11,520	27,200
Fifth foot	.306	.008	.272	.586	12,240	320	10,880	23,440
Total	.247	.010	.152	.407	48,960	2,080	30,400	81,440

The amount of alkali in this land is very great and chiefly held in the lower three feet. The depth to which the alkali has penetrated forms an exception to the general rule, for usually all is held above the fifth or even fourth foot.

The carbonate of soda (black alkali) present is not very great; but the amount of common salt is sufficient to produce destruction of nearly all orchard growths. Underdrainage and flooding the land is clearly the only remedy to be applied—thus washing the salts out of the land.

Alkali soils from Hynes, Los Angeles County; sent by J. C. Fredericks. The soils were taken from two holes; a sample of the upper six inches of each and of the full column from the surface to four feet in depth. They are in an artesian belt and water usually stands at six feet below the surface.

No. 1. This land has refused to grow barley for the past four years.

No. 2. This land grew corn six years ago; two years after that there was a heavy crop of alfalfa, but since that time both barley and alfalfa have failed to grow—except that here and there a little barley would reach a height of six inches.

		Percentage in Soil.				Pounds per Acre.			
		Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Salts	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Alkali
No. 1.	6 inches	.766	.404	.306	1.476	15,320	8,080	6,120	29,520
	4 feet	.097	.056	.093	.246	15,520	8,960	14,880	39,360
No. 2.	6 inches	.449	.037	.158	.644	8,980	740	3,160	12,880
	4 feet	.076	.020	.056	.152	12,160	3,200	8,960	24,320

In the first sample the upper six inches contain nearly all of the sulfate and carbonate, while the common salt is chiefly below that. In the second sample a large proportion of the carbonate and common salt is below the surface six inches, and its rise from still farther down has doubtless been the cause of failure of barley and alfalfa.

The injury has chiefly been done, doubtless, by the carbonate of soda in each soil, for the crops have elsewhere withstood a larger amount of common salt. Gypsum would be the proper remedy.

Alkali soils from near Anaheim, Orange County; sent by F. W. Braun & Co., of Los Angeles. "Walnut trees have been planted on this soil, but they soon die, and the butts and roots rot very quickly. When there has been considerable rainfall and the soil then becomes dry there appears a white substance on the surface; examinations by boring down show that at eight or ten inches there are streaks of a white tasteless powder that is thought to be alkali. Walnuts are doing exceptionally well outside of this affected tract."

There were only traces of carbonate of soda in these soils, and about equal amounts of sulfate and common salt. As determined, the latter comprised 6,040 pounds in the first foot, 5,120 pounds in the second foot, 4,200 pounds in the third, and 2,800 pounds in the fourth, or a total of 18,160 pounds of common salt per acre in four feet depth. This amount is above toleration on the part of any orchard tree, so far as ascertained.

Alkali soils from celery field near Westminster, Orange County; sent by M. C. Cole, Santa Ana.

The land is about two miles from the coast, is all lowland, with water at from two to three feet from the surface. The land is largely planted to celery. Two samples of soil were taken from each spot, one representing the upper six inches, the other from the surface to a depth of about three feet. No carbonate of soda was found in the samples.

No. 4. Smart-weed is the only weed on this spot; very large celery grows within 20 feet of where the sample was taken.

No. 5. This land lies about eighteen inches higher than No. 4, and is covered with saltgrass; good celery grows near the spot. Both this and the land from which No. 4 was taken have been recently tile drained.

Nos. 6 and 7 were from land that has never been under cultivation and is partly covered with white alkali efflorescence and alkali-weed.

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Salts	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Alkali
No. 1. *Celery will not grow*— Two feet	1.027	----	.276	1.303	82,160	----	22,080	104,240
2. *Celery, one half usual size*— Two feet	.121	----	.008	.129	9,680	---	640	10,320
3. *Celery, good growth*— Two feet	.340	---	.080	.420	27,200	---	6,400	33,600
4. *Within 20 feet of where Celery is doing well*—								
6 inches	.492	----	.064	.556	9,840	----	1,280	11,120
6 to 36 inches	.067	----	.009	.076	6,700	----	900	7,600
Total in 3 feet	.138	..	.018	.156	16,540	..	2,180	18,720
5. *Near where Celery is doing well*—								
6 inches	1.126	----	.196	1.322	22,520	----	3,920	26,440
6 to 36 inches	.932	----	.102	1.034	93,200	----	10,200	103,400
Total in 3 feet	.965	----	.118	1.083	115,720	---	14,120	129,840
6. *Not cultivated in Celery*—								
6 inches	1.123	----	.789	1.912	22,460	----	15,780	38,240
6 to 36 inches	.402	----	.306	.708	40,200	----	30,600	70,800
Total in 3 feet	.522	---	.387	.909	62,660	----	46,380	109,040
7. 6 inches	1.519	----	1.531	3.050	30,380	---	30,620	61,000
6 to 36 inches	1.106	----	1.076	2.182	110,600	----	106,000	216,600
Total in 3 feet	1.175	----	1.152	2.327	140,980	----	136,620	277,600

The results of the first three groups are interesting in showing the tolerance of celery for common salt and glauber salt. The plant made a good growth in the presence of 6,400 pounds of the former and 27,200 pounds of the latter per acre in two feet depth. It is unfortunate that a greater depth of soil was not examined, for the amount of salts would probably have been far greater. While the roots of the plant are confined to the upper two feet, there is always danger that the alkali below that depth may rise to the surface.

The alkali in other places in the field was very large, comprising for the most of the samples from one to two per cent of the weight of the soil.

Alkali soils from La Mirada, Los Angeles County; sent by Louis Blatz. The samples are from olive and lemon orchards that have been irrigated with water containing more than 30 grains of alkali salts per gallon, one third of which was common salt. The samples were taken to a depth of four feet.

Olive Orchard—Lot 3: Low part of the tract; trees stunted, six years old and only four feet high. Lot 3*a*: High part of the same orchard; the trees received the same treatment as the others, and are large and healthy.

Lemon Orchard—Lot 16*b*: Trees stunted, without showing signs of disease. Lot 16*a*: Trees doing well. Lot 11: Lower part of the orchard at the end of irrigation furrows where water has accumulated after each irrigation for the past five or six years; trees have been doing well until recently, when signs of disease appeared and most of them have died.

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Salts	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Alkali
Lot 3a. Olive trees healthy— In 4 feet	.025	.015	.014	.054	4,000	2,400	2,240	8,640
Lot 3b. Olive trees stunted— In 4 feet	.271	.029	.074	.374	43,360	4,640	11,840	59,840
Lot 16a. Lemon trees healthy— In 4 feet	.028	.003	.005	.036	4,480	480	800	5,760
Lot 16b. Lemon trees stunted— In 4 feet	.032	.003	.009	.044	5,120	480	1,440	7,040
Lot 11. Lemon trees dying— In 4 feet	.039	.007	.012	.058	6,240	1,120	1,920	9,280

While the olive trees naturally were stunted with 11,840 pounds of common salt per acre, they have tolerated as much as 7,000, together with more than 40,000 pounds of alkaline sulfates.

The lemon trees were extremely sensitive to alkali, for they were stunted in presence of 1,440 pounds of common salt. The orchard was improved by a system of flooding with irrigation water, which forced the alkali down deep into the soil out of the reach of the roots; this was followed by cultivation of the soil to prevent the alkali from rising to the surface again.

Alkali soils from the beet fields of the beet-sugar factory at Chino; sent by the sugar company.

	Percentage in Soil.				Pounds per Acre.			
	Alkaline Sulfates	Carbonate	Chlorid	Total	Alkaline Sulfates	Carbonate (Sal Soda)	Chlorid (Common Salt)	Total Alkali
Section 14, Lot 39—								
First foot	.062	.017	.003	.082	2,480	680	120	3,280
Second foot	.003	.004	.005	.012	120	160	200	480
Third foot	.015	.003	.005	.023	600	120	200	920
Fourth foot	.007	.005	.004	.016	280	200	160	640
Total	.022	.007	.004	.033	3,480	1,160	680	5,320
Section 23, Lot 31—								
First foot	.384	.020	.010	.414	15,360	800	400	16,560
Second foot	.017	.020	.005	.042	680	800	200	1,680
Third foot	.012	.003	.003	.018	480	120	120	720
Fourth foot	.003	.004	.005	.012	120	160	200	480
Total	----	----	--------	------	16,640	1,880	920	19,440
Section 24, Lot 20—								
First foot	.104	.020	.009	.133	4,160	800	360	5,320
Second foot	.016	.003	.005	.024	440	120	200	960
Third foot	.007	.002	.009	.018	280	80	360	720
Fourth foot	.012	.007	.005	.024	480	280	200	960
Total	-------	------	--------	--------	5,360	1,280	1,120	7,960

Alkali soils from two and one half miles southeast of Compton, Los Angeles County; sent by Nelson Ward. No. 2 was taken 150 yards from No. 1.

		Percentage in Soil.				Pounds per Acre.			
		Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Salts	Alkaline Sulfates	Carbonate of Soda	Chlorid of Sodium	Total Alkali
No. 1.	First foot	.499	.013	.178	.690	19,960	520	7,120	27,600
	Second foot	.408	.014	.014	.436	16,320	560	560	17,440
	Third foot	.122	.014	--------	.136	4,880	560	-------	5,440
	Total	.343	.014	.064	.421	41,160	1,740	7,680	50,480
No. 2.	First foot	1.213	.020	1.235	2.468	48,520	800	49,400	98,720
	Second foot	.211	.020	.187	.418	8,440	800	7,480	16,720
	Third foot	.057	.012	.075	.144	2,280	480	3,000	5,760
	Total	.494	.017	.499	1.010	59,240	2,080	60,420	121,200

The amount of common salt in each of these soils, and especially in No. 2, renders them unfit for most orchard trees and for many cultures. The only remedy is the leaching of the soils by excessive irrigation.

Saline soils from Thermal, near Indio, Riverside County; sent by H. Adin Green.

	No. 1.		No. 2.	
	Per cent.	Pounds per Acre.	Per cent.	Pounds per Acre.
Sulfates of alkalies	.296	11,840	6.340	253,600
Carbonate of soda	.012	480	.050	2,000
Chlorid of sodium	.482	19,280	11.950	478,000
Total alkali	.790	31,600	18.340	733,600

These soils are each too highly charged with common salt (chlorid) to permit the growth of any cultural crop other than saltbush or perhaps date palms.

Garden earth from the summit of San Bernardino Mountains; used for composting with stable manure and then for potting citrus nursery stock. Sent by the Chase Nursery Company, Riverside. White spots of what seemed to be alkali appear in the mass of soil when dried out.

The examination showed the presence of only about 3,000 pounds of alkali salts per acre foot, one third of which was common salt.

Alkali soil from C. F. Edwards, Saticoy, Ventura County. The examination of this soil shows the presence of seven tenths of one per cent of total alkali, which is equivalent to 30,000 pounds per acre per foot in depth. Of this amount, glauber salt forms the chief constituent, 2,000 pounds being common salt. There is very little carbonate of soda present. Many crops would be successful on this land.

ALKALI RECLAMATION AT TULARE SUBSTATION.

By C. H. Shinn.

The work put upon the "black alkali" spots here since 1889 is shown clearly by the charts which accompany this report. The rise of alkali and its reduction by the continued use of gypsum is illustrated. The detailed history of this work is scattered through previous reports.

At this time it is hardly needful to say that efforts to conceal the presence of alkali in a given district or on a given tract of land, or to minimize the necessity of facing the problem in all its bearings, have never been long successful. Wheat will not grow any better on "black alkali" by reason of a misleading label on the soil.

The true alkali salts which, when present in the soil, render the soil-water caustic and corrosive, and destroy vegetation, are the alkaline carbonates, such as carbonate of sodium (sal soda) and carbonate of potassium (saleratus). When Thompson's "prize essay" on alkaline soils of California was read before the State Agricultural Society in 1857, it simply urged leaching-out deleterious salts by copious irrigation, and recommended the growth of legumes and plants with bulbous roots. His observations had hardly extended farther south than the saline soils around Stockton, and the data from which he drew his conclusions respecting alkali-resisting vegetables were, as we now know, misleading. In fact, the classes of plants recommended by him are peculiarly susceptible to alkali corrosion.

Since 1857, as cultivation has extended up the San Joaquin Valley, as extensive irrigation works have been developed, and as the needs of diversified horticulture have created new industries, the solution of the alkali problem, as set forth in the publications of the California Experiment Station, has been clearly defined. Briefly it may be stated as follows: control of irrigation, control of drainage, study of the extremely varying kinds and degrees of alkali, and use but not waste of gypsum where needed to neutralize carbonates.

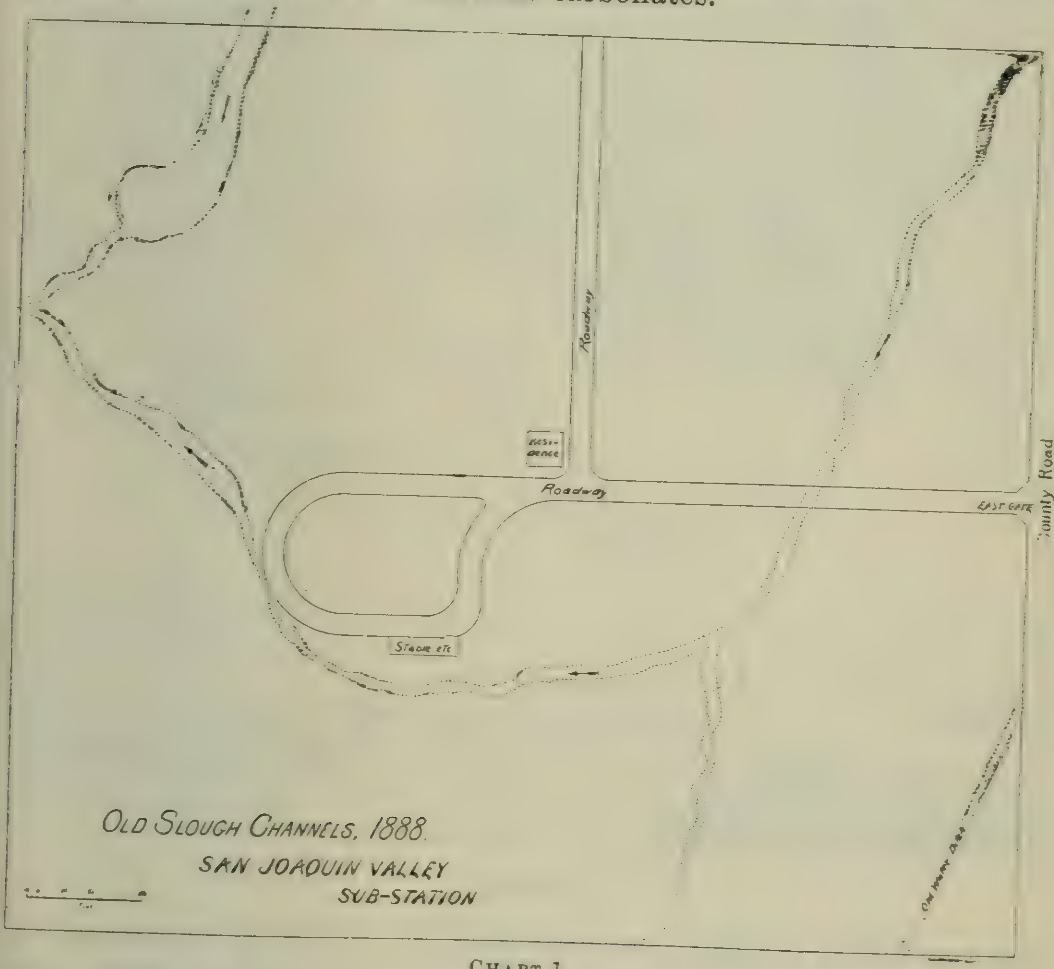


CHART 1.

The Substation in 1888 and Earlier.—The best way to describe the work of reclamation here is to show by a series of charts with accompanying notes the history of this place respecting alkali since its establishment.

Chart 1, entitled "Old slough channels, 1888," shows the station tract as it appeared before it was plowed or any planting was done. The surface sloped irregularly from northeast to southwest. The "slough channels," so called, were merely the remains of old drainage courses across the valley from the Sierra toward Lake Tulare, and are to be found of varying sizes and depths in this entire region. They correspond to a great degree to the distribution of alkali throughout the country, but many large deposits are related to older and now buried channels which can not be traced, or to smaller side channels now obliterated, or, as sometimes appears evident, are due to the general rise of carbonates, sulfates, nitrates, chlorid of sodium, etc., from below.

Nothing has been more manifest in the course of these investigations than the changes from season to season in the distribution and the actual amounts of the various alkali salts present on this tract. A glance at plate 7, the last of the series, to be hereafter discussed more in detail, shows that the station tract of twenty acres is surrounded by large and heavy deposits of alkali. These are in nowise fixed quantities, but rise and fall, ebb and flow, according to the amount of rainfall (or irrigation) and the drainage. Hence, the problem of reclamation is really, like most questions of improvement, one which concerns the entire area affected.

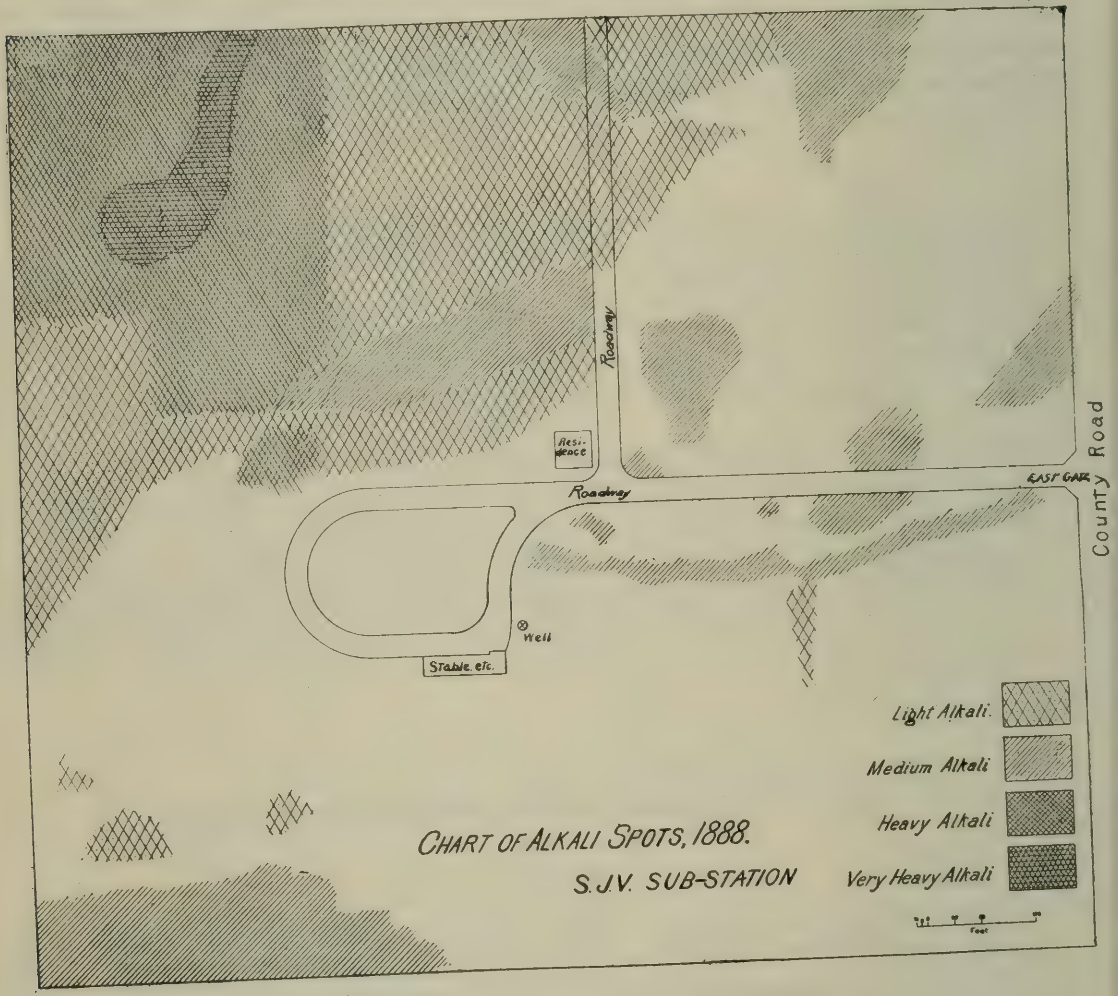


CHART 2.

The Actual Alkali Conditions.—Chart 2, entitled "Alkali spots, 1888," and Chart 3, "Alkali spots as published in 1889," should be studied together. Their history is as follows: In the fall of 1888, when Mr.

Julius Forrer first went to the substation, he made a chart of the alkali spots from the growth of native vegetation, and this was then extremely accurate. When the ground was plowed up, in the spring of 1889, the season being a very good one, the alkali was less manifest, and so in the published chart of that year the record was made considerably below that of the original station map of 1888, now first published. The discrepancies can be plainly seen (1) by the marking of "very heavy alkali" on the chart of 1888 (absent from that of 1889), (2) by the greater extent of "medium alkali" in 1888, and by its presence even then south of the roadway where the vineyard now stands.

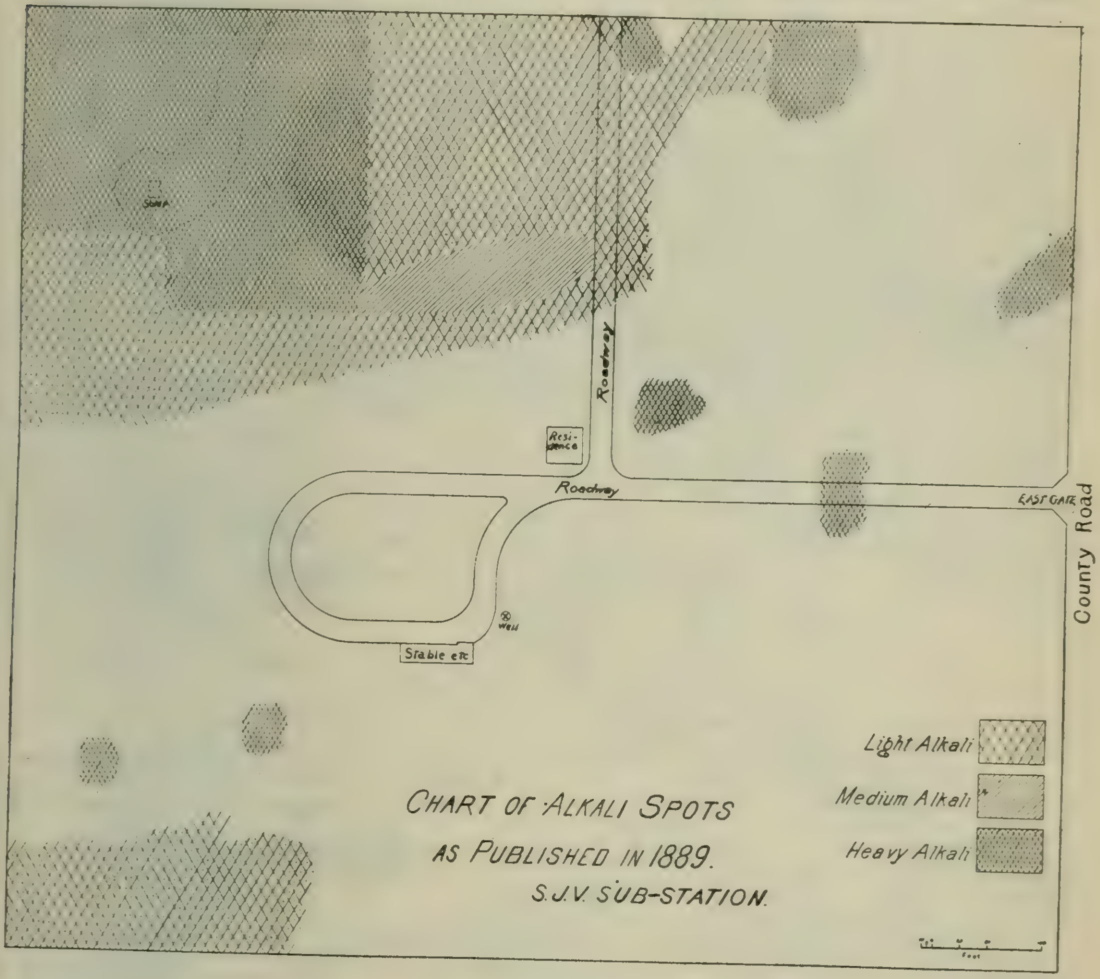


CHART 3.

The differences between these two charts will plainly show the variation from season to season. Considered culturally, the chart of 1888 showed clearly that grapevines and barley would grow well on the blank areas marked as "light alkali." Wheat, in seasons of sufficient rainfall, was successfully grown on a good deal of this "light alkali." But wheat, and sometimes all cereals, failed on the "medium alkali" areas, and grapevines did very poorly here, finally perishing; while on the "heavy alkali" areas no plants could be grown.

Partial Reclamation in 1893.—Chart 4, "Alkali spots in 1893, partly reclaimed," shows two things plainly: the beginning of a rise of alkali due to several wet seasons, and the gradual amelioration of the worst areas by cultivation and the use of gypsum (the carbonates everywhere predominating in the alkali combination). Compared with Chart 3, the changes are considerable; and compared, as is more correct, with Chart 2, they are more manifest. The alkali has spread farther, but it has been modified and to a large degree conquered. Wheat was successfully grown in 1893, 1894, and 1895 over the greater portion of the western ten acres of the tract. The only places where wheat would not grow were on the heavy alkali cores, and even here the seed germinated and made some start. When the charts are compared with each other some shifting of the centers of strongest alkali will be observed from season to season. This has always been noticed in respect to vegetation, and soil analyses confirm it. The shifting of alkali cores is naturally more pronounced in years of greatest rainfall or of most irrigation.

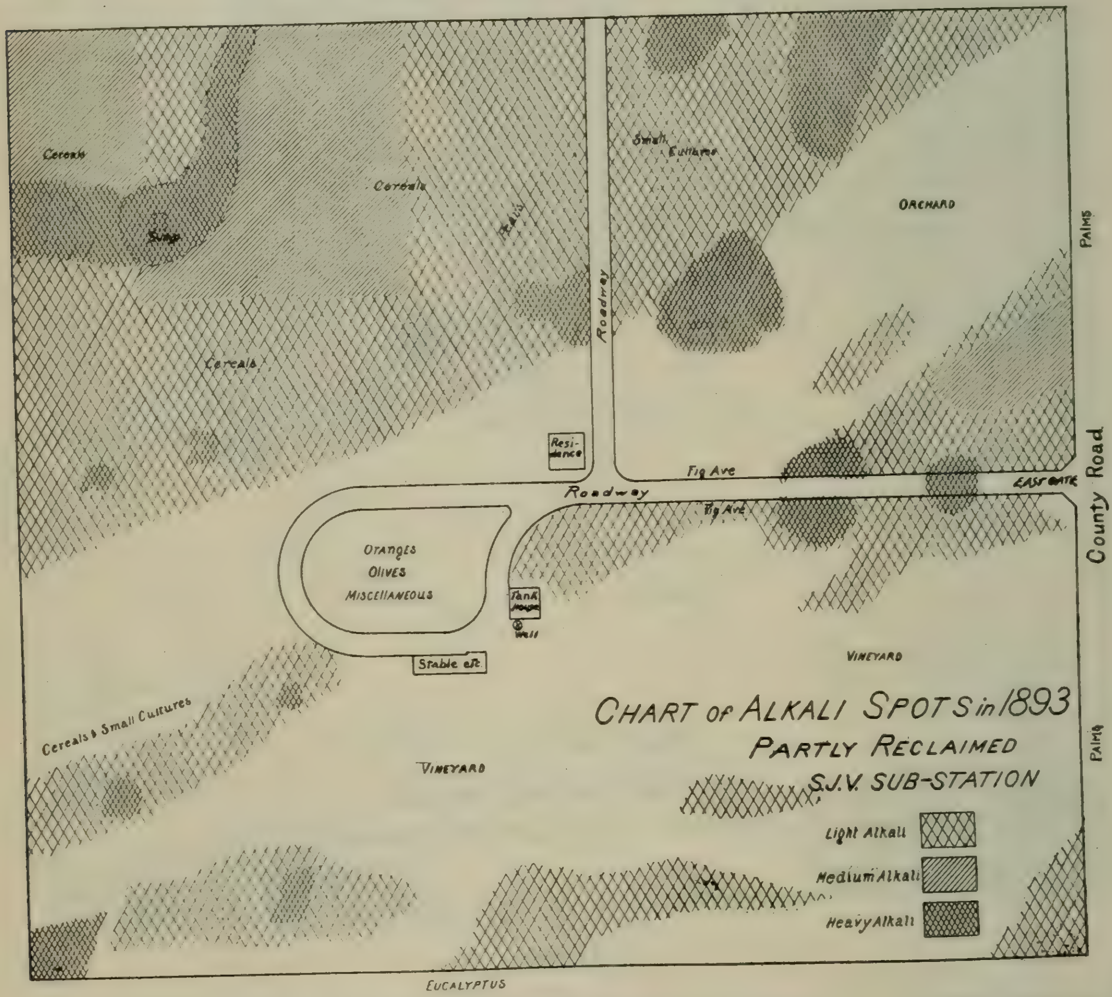


CHART 4.

The vineyard on the southeast corner of the tract was doing much better at the time this chart was made than was the orchard on the northeastern corner. In fact, no reclamation work was being done on the eastern side of the tract; it was concentrated on the western half. Hence, the rise and extension of alkali on the eastern side, where it was increased in winter from large deposits east and north (see Chart 7), were quite manifest.

Serious Rise of Alkali.—Chart 5 is one of the most striking of the series. It shows the "rise of alkali" at its height after some irrigation had been carried on upon surrounding farms (not in the station tract). It also exhibits the condition at that time of some of the adjacent tracts on all four sides of the substation.

As in the case of all the charts given in this paper, excepting Nos. 1 and 2, the measurements, notes, and original drawings were made by the writer on the ground at the times specified. The notable feature of Chart 5 is the increase of very heavy alkali. The pressure upon the station tract from large alkali deposits chiefly north and west is very distinct. The maintenance of reclamation, even under these conditions, is especially manifest in the northwestern corner, and near the northeastern corner, where a prominent "tongue" of alkali is sharply reduced from "heavy" to "medium" as it enters the station tract.

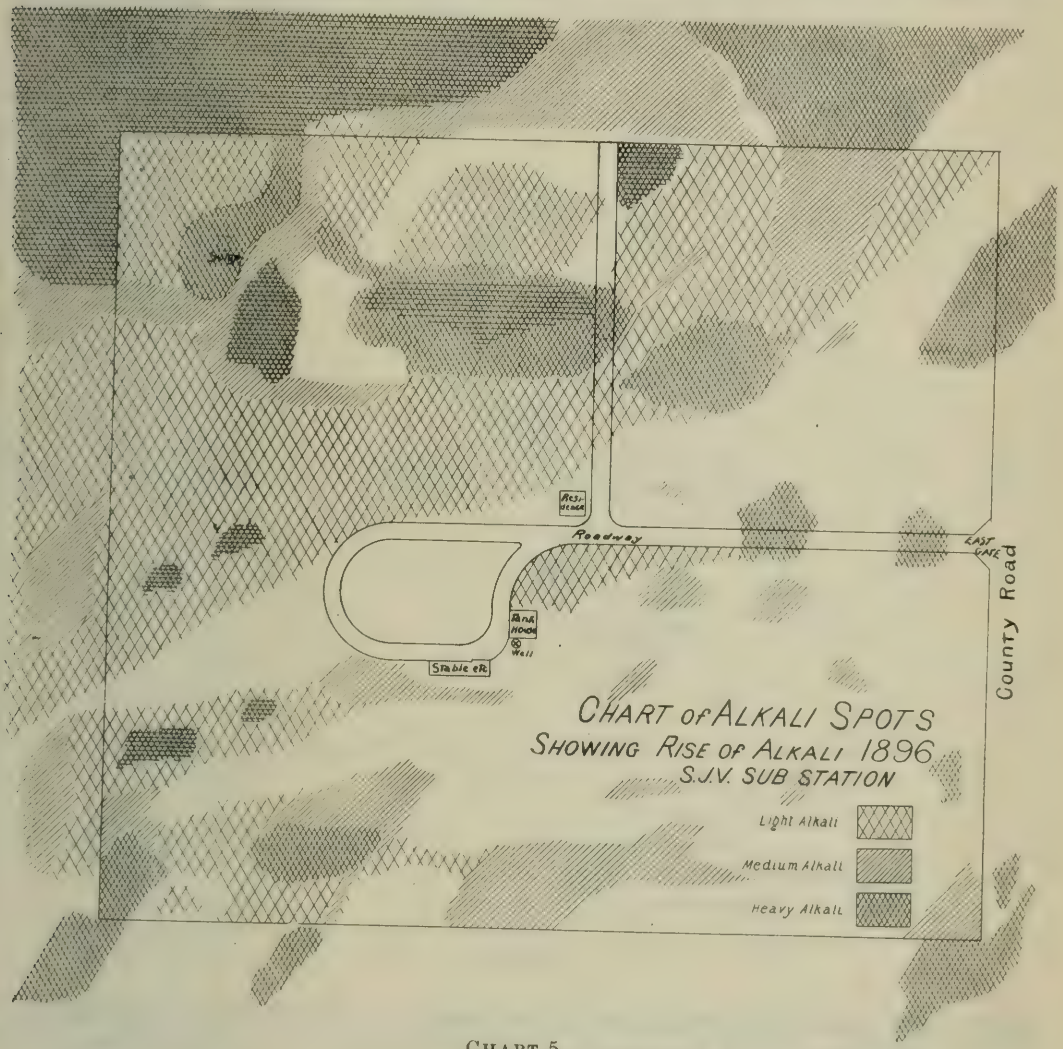


CHART 5.

But on the whole, the chart shows increase of alkali and loss of much which had been gained. Cultural experiments confirmed this, the wheat crop being a failure over about three fourths of the western half, and on one third of the northeastern quarter of the entire area.

Reclamation Work Between 1896 and 1899.—After this rise of alkali, a second "sump," or drainage pit, cut through to the gravel, and a deep ditch to cut off to some degree the inflow from the north, were resorted to. More gypsum was used, with great care to apply it in proportion to the requirements of each alkali core.

In order to handle the tract better, it was measured off into plots, each of which represented a small area in especial need of treatment. Soil and water analyses were carried on by Professor Loughridge, so as to direct the reclamation. A first-rate crop of wheat was obtained in 1898, 1899, and 1900 over most of the areas on which wheat had failed in 1896. This was fully discussed and illustrated in the Report for 1897–8 (pp. 301–306).

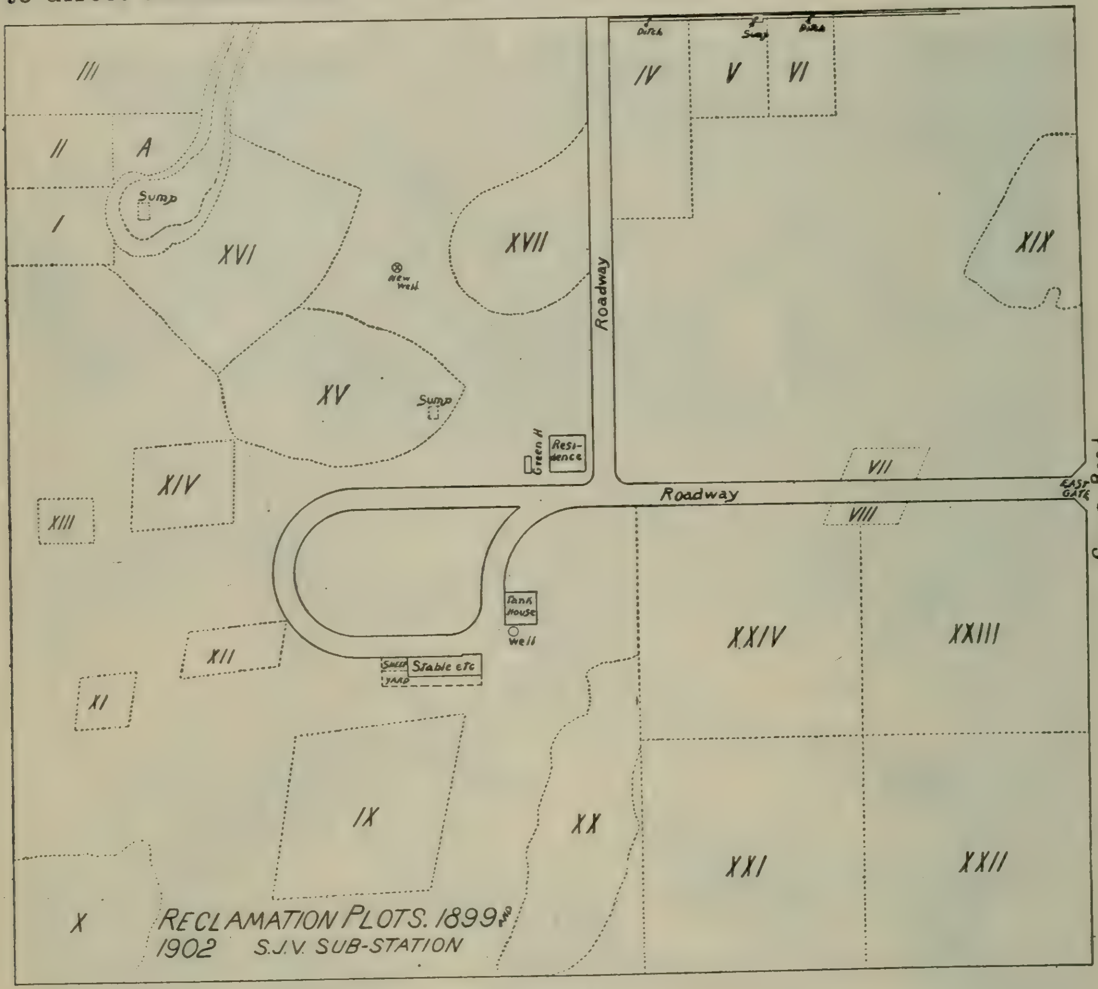


CHART 6.

Reclamation Plots, 1899–1902.—At the present time the plots charted and being cultivated at the substation number twenty-four. (See chart 6.) A part of the orchard is not charted, but gypsum has been applied to it as needed. The vineyard has been divided, for convenience, into four large plots, but most of the work done was on portions of XXIII and XXIV. Plot XX is also in the vineyard, and was treated in the same way. In these five plots, therefore, the only object was to protect the vineyard against further rise of alkali, and this has been accomplished.

On plots I to XIX inclusive, the main work of reclamation has been done since 1896. The size of the areas of heavy alkali has been in all cases much reduced, often to but one fourth the previous size. All the medium alkali has been brought down to a light grade, and much of the light alkali is now below the original scale for that amount. Nearly all the carbonates present in the plots have been transformed by gypsum into sulfates, even on the heavier soils. At some points the carbonates still remain in sufficient amount to prevent seed from germinating easily in this very heavy soil. The season of 1901-2 was so dry that wheat failed to germinate over much of the tract, but irrigation from the new well has made a fair crop wherever applied in season.

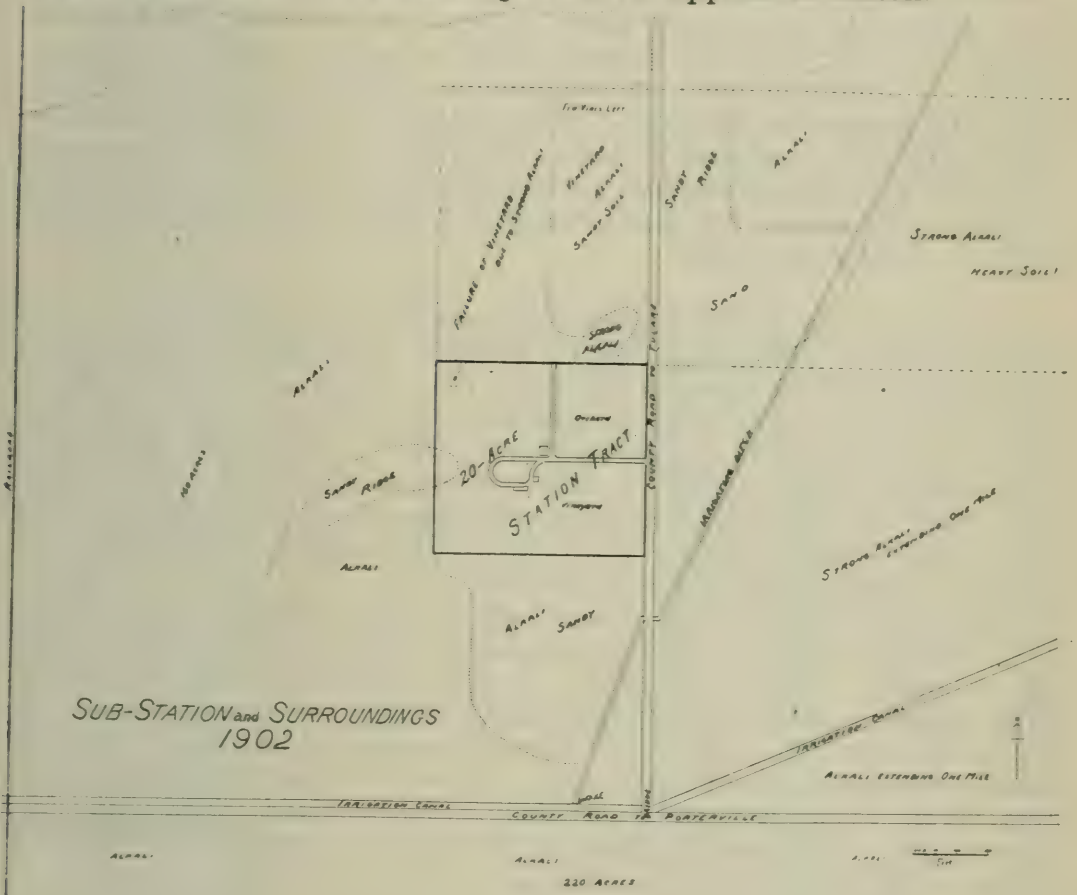


CHART 7.

The worst portions of the tract are now the following: Plot XIV, over an area of 100′ x 100′; plot XI, over an area of 24′ x 40′; plots V and VI, over areas collectively of 50′ x 75′; and smaller portions of some other plots. Scattered heads of wheat grew even in these alkali cores in the spring of 1902, and in a good year large crops would be obtained. But rains followed by drought packed the soil after sowing. The difficulties were physical, not chemical.

Alkali Surroundings.—Chart 7 shows the surroundings of the substation as they now appear. The irrigation ditch contains no water at present, the district having been abandoned some time ago. The rise of alkali has been very noticeable in this surrounding region since 1896. Within the area mapped, several orchards of peaches, apricots, pears, and olives have been abandoned since that date, and one large and one small vineyard have become worthless. In fact, ten acres of vines remain directly north of the substation, but they are not now pruned or cultivated.

The substation tract, sloping from northeast to southwest, has a sandy soil over its larger portion, but this is on a quite compact sandy subsoil. The strong alkali soil of the northern portion of the tract is much heavier. The extreme southeastern corner is very sandy, and showed almost no alkali in 1888. While the irrigation ditch was in use, considerable wastage occurred south and east of the substation, and the vineyard suffered from surplus alkali; so did olive trees planted along the county road. In recent years most of the vineyard has entirely recovered. The rise of alkali east of the substation was such that one field of six acres, where wheat had been successfully grown, was finally planted to Australian saltbush. Even this was destroyed by overflow from the ditch, for saltbush will not endure heavy irrigation in summer. A small orchard adjoining this six acres was given up, owing to alkali; but palm trees and a few black locust and umbrella trees continue to maintain themselves there.

Amount of Gypsum used since 1888.—Under the supervision of the late Mr. Klee, in 1889 three tons of gypsum were applied to the entire twenty acres, and in especial amounts around the trees and vines then newly set. Two more tons of gypsum, presented to the substation, were used in 1890. This last lot was so nearly inert that no results were obtained, and therefore it finds no place in the record. Since 1891 there have been 103 tons of gypsum purchased, at an average cost of $5 per ton, delivered in Tulare City. This would make a total of 106 tons of fairly good gypsum bought since 1888.

As about six tons remain unused at the time this is written (May, 1902), we can estimate 100 tons as used in thirteen years, or an average of about 7.7 tons per year. As the application was to twenty acres, the average amount applied per acre during the whole period has been 5 tons; and the average per acre per year, .384 of a ton. But the actual percentage of pure gypsum in the various lots purchased ranged from 60 to 80 per cent, or an average of 70 per cent. Reducing our calculations to the basis of pure, or 100 per cent, gypsum, we find that if this grade could have been obtained, 5.39 tons per annum instead of 7.7 tons would have been sufficient, and the other figures would be reduced in proportion. The importance of obtaining a high grade of gypsum is manifest. When the deposits are more carefully worked, it will prove easier to purchase a 90 per cent article than it now is to obtain a 70 per cent, and in time, with competition, the cost may be materially reduced.

Proportionate Application of Gypsum.—In the four years since 1897 the vineyard of six acres has received 34,000 pounds of gypsum, or 17 tons, which is equal to 4¼ tons per year. This is a profitable use of gypsum, as the crops have been large and the vines have been kept healthy, for which an annual expenditure of less than $4 per acre is little to pay. Two near-by vineyards, on similar soil containing no more alkali, have been practically abandoned since 1897.

The bearing of this result is plain. Large areas of land in this immediate district, if planted to wine, raisin, or table grapes and properly protected by the use of gypsum, as just outlined, would prove good investments. The fact that nearly 75,000 cuttings of the best wine grapes were sent out last winter (1901–2) by the substation shows that the success of this vineyard has made an impression.

The northwest quarter of the tract, about four acres (outside of the charted plots), has received nearly 3½ tons of gypsum for several years past. The result has been to restore the apple trees to a high degree of health and to materially improve the plums and even the peaches. The pear orchard is not included in this estimate.

A great deal of gypsum has been used in the aggregate for small, almost weekly applications around trees and vines which showed signs of suffering from carbonates. No account could be kept of these separate items extending over almost the whole history of the substation. Much was used in the grain fields, first sown broadcast before the early rains, afterward worked in by plowing and cross-plowing. Since 1896 nearly thirty tons have been used in this way upon areas outside of the plots. The following table shows the proportionate application of gypsum on different plots in recent years:

TABLE SHOWING USE OF GYPSUM ON PLOTS.

Division.	1897–1898.	1899–1900.	1901–1902.	Total in 5 Years.
	lbs.	*lbs.*	*lbs.*	*lbs.*
Plots 1, 2, 3	3,600	6,060	1,500	11,160
Plot 4	800	1,440	800	3,040
Plot 5	450	1,060	400	1,910
Plot 6	450	2,000	600	3,050
Plot 8	450	1,000	300	1,750
Plot 9	750	3,200	500	4,450
Plot 10	1,200	1,920	600	3,720
Plot 11	450	480	200	1,120
Plot 12	1,510	1,600	800	3,910
Plot 13	380	400	500	1,280
Plot 14	500	720	300	1,520
Plot 15	1,050	1,760	300	3,110
Plot 16	3,600	4,220	900	8,720
Plot 17	1,050	1,660	600	3,310
Plot 18	1,200	1,120	300	2,620
Plot 19	300	1,340	300	1,940
Extensions of plots	2,100	950	900	3,950
Pear trees	1,200	1,500	2,250	4,950
Totals	21,030	32,430	12,050	65,510

It is easily seen that plots 1, 2, and 3, which have been worked in practice as one, and plot 16, represent a large part of the work done, though 4, 5, and 6 also required much gypsum. Analyses show that the carbonates in all the above plots are reduced below 1,000 pounds per acre four feet deep, which makes a wheat crop safe in years of sufficient rainfall. All of these plots can now be much more easily cultivated than before, and are in every respect improved.

A General View.—The worst remaining alkali on the tract is near the old sump and on a portion of plot 16; also, near the north gate on the western edge of plot 4; also, at several points in the southwest quarter of the substation. A number of test plantings have been made for several years past, particularly on plots 4 and 8; plot 4 is still very bad.

In the spring of 1902 hairy vetch, broad bean, sunflowers, kale, carrots, okra, mangel-wurzels, and melons failed here; Essex rape did fairly well, and rye made a little growth. On plot 8 all these cultures failed, and also Batavian dandelion. But, as elsewhere noted, the true artichoke (Cynara) throve exceedingly.

Plot 7, of which no especial mention has been made, was originally a "swept plot," from which the surface alkali was brushed off and removed at intervals. It inadvertently received 125 pounds of gypsum, but the removal of surface alkali was continued and another "swept plot" was marked out of new soil. Saltbush has been growing on plot 7 for some time past.

WATERS.

The waters grouped in their natural divisions comprise lake and stream, spring, common wells, artesian wells, and reservoirs and irrigation ditches. A general summary of the results of examination is given in Part I of this report, while in this part is given in detail the analysis of each sample, as made by Messrs. Colby, Snow, and other laboratory assistants.

Another grouping has, for convenience, been made in the tables, viz., as to suitability or non-suitability for domestic or irrigation use. If a water containing as much as ten grains of alkali per gallon be used in sufficient amount to equal 20 inches of rainfall, or applied at the rate of about 7,000 gallons per tree in the orchard, it is calculated that the soil will receive about 800 pounds of alkali salts per acre. If this were either common salt or the carbonate of soda, then in three or four seasons there would be accumulated a sufficient amount to severely injure citrus and many deciduous orchard trees, as well as many smaller cultures. A larger amount of sulfates or glauber salt would be required before injury resulted, most of the cultures being able to tolerate as much as 20,000 pounds per acre in four feet depth.

Whenever, then, a water is found to contain from 10 to 18 grains of carbonate of soda or common salt, or 75 to 100 grains of glauber salt per gallon, it is placed in the "doubtful for permanent irrigation" list; while an amount higher than 18 grains places the water in the "unsuitable for irrigation" group.

In some cases there are high amounts of carbonate of soda which may be neutralized and changed to the sulfate in the soil by the application of gypsum to the land. These naturally belong to the doubtful group.

For ordinary domestic use the presence of upward of 40 grains of soluble salts (sulfates, chlorid, and carbonate) per gallon is usually regarded as beyond the endurance of the systems of most persons.

A subdivision of the "suitable for irrigation" waters is therefore made, for the purpose of eliminating those which are unsuitable for domestic use.

STREAM AND LAKE WATERS.

Twenty samples of waters from lakes and streams were received, and only seven of these are to be regarded as suitable for use. The water of Feather River, from Butte County, is exceptionally pure, for it contains only six grains of mineral salts per gallon. That of Pajaro River, from near Watsonville, is more highly charged with mineral matters, and 6.7 grains of common salt per gallon places it up toward the danger line for irrigation purposes on heavy soils, though safe on light soils. Feather River has its source among the snows of the high Sierra, while

LAKE AND STREAM WATERS.

Locality.	County.	Sender.	Taken From.	Grains per Gallon.						
				Total Salts	Glauber Salt	Common Salt	Sal Soda	Lime Carbonate	Silica	Organic Matter
SUITABLE FOR IRRIGATION.										
Berkeley	Alameda	W. Yzell	Crab Creek ‡	16.06	.60	.68	3.10	7.88	1.46	2.34
Gridley	Butte	H. Cook	Feather River	6.13	1.12	.68	1.24	.58	2.34	.17
Willows (out of cañon)	Glenn	T. L. Knock	Willows Creek	47.89	20.83	1.36	2.05	17.23	1.75	4.67
Watsonville	Santa Cruz	Mr. Driscoll	Pajaro River	44.32	19.38	6.76	1.85	6.71	3.21	6.41
Orange	Orange	Jackson & Perkins	Creek	41.11	10.09	4.73	.63	19.83	1.75	4.08
Anaheim	Orange	W. Fay	River	24.24	4.39	4.32	.19	13.12	1.33	.89
Ventura	Ventura	A. Frazer		52.48	16.43	2.72	1.26	19.82	.58	11.67
OF DOUBTFUL USE.										
Willows	Glenn	T. L. Knock	Creek	82.35	34.14	2.04	.62	27.57	.46	17.52
Lompoc	Santa Barbara	H. Dutard	Creek	63.26	29.91	6.82	1.24	19.56	3.39	2.34
Lompoc	Santa Barbara	H. Dutard	Creek	68.92	18.54	† 17.05	1.21	24.53	2.63	4.96
Corona	Riverside	Water Company		36.15	8.81	10.86	.74	11.08	---	4.66
Corona	Riverside	Water Company		31.76	9.09	9.50	1.23	5.24	2.33	4.37
Santa Monica	Los Angeles		Cañon Creek	72.31	36.15	4.05	.70	20.30	1.28	9.33
Santa Barbara	Santa Barbara	J. T. Craveole	Tunnel	32.71	1.17	11.59	*14.86	1.29	2.63	1.17
NOT SUITABLE FOR IRRIGATION.										
Willows	Glenn	T. L. Knock	Creek	159.05	96.79	6.82	1.24	27.04	.40	26.76
Punta Gorda	Ventura	F. Graynor	Cañon	370.61	107.95	65.02	160.72	11.25	2.92	22.75
Punta Gorda	Ventura	F. Graynor	Cañon	872.77	616.44	81.17	49.45	45.49	.87	79.35
Corona	Riverside		Lake	116.18	22.03	53.62	22.89	7.01	2.45	8.18
San Diego	San Diego	G. P. Hall	Lake	228.01	41.11	130.26	1.23	21.58	4.67	29.16

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* If gypsum be applied to the land.

† Near danger-line for many cultures, especially citrus trees.

‡ Washington.

the Pajaro with its tributaries drains a large part of the upper portion of the Santa Clara Valley, and we would naturally find more salts in the latter.

A number of these waters are quite "hard" from the presence of lime carbonate.

There is quite a difference in the content of mineral salts in the waters of Willows Creek, Glenn County, before it emerges from the hills and after it reaches the plains of the Sacramento Valley, as shown in the total salts, glauber salt, and lime carbonate.

Among the group of unsuitable waters there are several that might be used for irrigation except for the fact that their content of glauber salt is rather large to be applied on any but sandy lands where good drainage is afforded.

SPRING WATERS.

The waters of springs have usually not volume sufficient to be used for irrigation purposes, hence their examination is chiefly with regard to their fitness for domestic purposes.

Sixty-seven samples are included in the accompanying tables; of these, about 45 per cent only were found to be suitable for use. Several of the springs, notably from Colusa and Placer counties, contain an enormous amount of mineral salts, and are suitable for medicinal purposes only.

Several of the waters which can be used contain quite an amount of lime carbonate, which produces a hardness that unfits them for boilers and for washing purposes. The usual method of boiling, or treatment with sal soda and allowing the precipitate to settle, will free them from most of the lime.

SPRING WATERS.

Locality.	County.	Sender.	Grains per Gallon.						
			Total Salts	Glauber Salt	Common Salt	Sal Soda	Lime Carbonate	Silica	Organic Matter
SUITABLE FOR DOMESTIC USE.									
Foothills.									
Confidence	Tuolumne	H. Teeters	12.85	5.74	----	----	----	----	----
Great Valley.									
Delonigha (lower)	Kern	H. H. Fish	23.36	7.23	1.47	6.19	2.34	3.79	2.34
Delonigha (lower)	Kern	H. H. Fish	22.78	4.26	6.82	1.48	3.50	2.34	4.38
Delonigha (lower)	Kern	Dr. R. A. Fergusson	18.57	7.45	1.36	4.33	1.46	2.63	1.34
Delonigha (lower)	Kern	Dr. R. A. Fergusson	19.27	2.59	4.77	6.19	1.75	2.04	1.93
Lindsay (No. 1)	Tulare	J. T. Bearss	12.21	1.20	.68	4.95	1.23	2.40	1.75
Lindsay (No. 2)	Tulare	J. T. Bearss	13.90	1.02	.68	6.19	1.46	3.21	1.34
Daunt	Tulare	J. M. Nelson	36.74	some	some	trace	29.74	----	----
Coast Range.									
Eureka	Humboldt	H. H. Buhne	13.72	.35	.68	2.47	5.84	1.17	3.21
San Anselmo	Marin	Presbyterian Oph'ge	‡10.50	----	----	----	----	----	----
Napa Soda	Napa	Theo Gier Co.	7.87	1.02	.67	1.23	.58	3.49	.88
Windsor	Sonoma	L. D. Latimer	21.57	9.91	----	----	11.66	----	----
Oakland	Alameda	Miss M. Thewstauf	33.58	7.29	.68	3.71	14.89	.58	6.43
Pleasanton	Alameda	Theo Gier Co.	27.99	----	----	----	----	----	----
Martinez	Contra Costa	L. M. Lasell	28.09	9.05	2.70	3.70	7.29	1.86	3.49
Templeton	San Luis Obispo	N. Downey	37.09	10.40	1.34	1.23	14.37	2.92	6.83
Mountain View	Santa Clara	P. Klein	26.87	4.77	.68	1.26	13.73	3.21	3.22
Los Gatos	Santa Clara	W. R. S. Jenks	34.98	----	----	----	17.49	----	----
Los Gatos	Santa Clara	W. R. S. Jenks	34.98	----	----	----	20.99	----	----
Soquel	Santa Cruz	R. Lathrop	28.04	7.53	.68	3.71	11.45	2.92	1.75
Soquel	Santa Cruz	R. Lathrop	25.70	8.35	.68	5.57	7.59	1.17	2.34
Southern California.									
San Diego	San Diego	B. H. Burke	30.66	7.35	6.82	2.47	8.18	3.50	2.34
Pala	San Diego	Mrs. S. M. Utt	24.02	8.61	6.76	3.70	1.75	1.28	1.92
Tecalote Springs	Santa Barbara	T. B. Bishop	35.04	4.67	3.40	1.86	17.81	.88	6.42

Santa Barbara	Santa Barbara	J. Ogram	24.49	small	small	some	9.33		
Ventura	Ventura	H. H. Taylor	24.41	2.99	2.04	.93	11.32	1.29	5.84
La Mirada	Los Angeles		12.24	small	small	small	small		
Santa Monica	Los Angeles		19.81	4.88	1.35	1.35	5.83	2.91	3.49
Elsinore Hot Springs	Riverside	C. S. Traphagen	19.82	7.07	3.38	2.67	1.92	1.87	2.91
Elsinore White Sulphur	Riverside	C. S. Traphagen	19.40	4.09	5.07	2.67	2.33	2.91	2.33
DOUBTFUL FOR IRRIGATION; UNSUITABLE FOR DOMESTIC USE.									
Willows	Glenn	T. L. Knock	85.51	37.60	4.09	1.23	25.43	.11	17.05
San Francisco	San Francisco	H. Brethoff	103.56	6.04	1.36	8.66	76.22	5.26	6.02
Oakland	Alameda	M. Thewstauf	48.30	11.20	4.77	*26.61	1.81	.58	3.33
San Miguel	San Luis Obispo	A. F. Benton	56.46	1.57	†13.55	.63	28.28	3.09	9.34
Corona	Riverside	J. H. Moore	66.65	38.18	2.03	.61	15.75	3.67	6.41
Santa Ana	Orange	A. R. Morrison	55.98	chief	little	trace			
Santa Monica	Los Angeles		63.10	32.25	3.38	1.11	16.45	1.75	8.16
Santa Monica	Los Angeles		72.31	36.65	4.05	.70	20.30	1.28	9.33
Santa Monica	Los Angeles		57.32	30.04	2.70	.50	17.26	2.74	4.08
NOT SUITABLE FOR DOMESTIC OR IRRIGATION USES.									
Foothills.									
Carbondale	Amador	J. O. Jones	514.31	315.98	148.81	1.86	22.83	2.05	22.78
Lincoln	Placer	J. H. Neville	796.02	642.98		1.85	104.25	1.22	45.72
Sonora	Tuolumne	James McCormick	283.87	120.23	.68		121.78	4.38	36.80
Great Valley.									
Colusa	Colusa	Alex. Brown	142.88				21.58		11.66
Colusa	Colusa	Alex. Brown	1,333.15				64.15		44.32
Colusa	Colusa	G. D. Metcalf	1,511.60				3.49		87.49
Rumsey	Yolo	J. M. Madden	100.30				29.16		
Dos Palos	Merced	C. F. Fry	138.96		129.95	1.85	1.16	3.38	2.62
Warthen	Fresno	Bray & Secord	304.32	40.49	218.92	9.28	25.70	1.17	8.76
Daunt	Tulare	J. M. Nelson	388.85		chief		39.65		
Bakersfield (Gill)	Kern	Jewett & Blodget	93.31				27.99		
Bakersfield (Upper Cañon)	Kern	Jewett & Blodget	72.89				31.49		
McKittrick	Kern	Hartford Oil Co.	187.54	large	consid.	1.24	88.08		
Coast Range.									
Combs Spring No. 1	Trinity	E. S. Wemple	484.04				104.97		
Combs Spring No. 2	Trinity	E. S. Wemple	99.71				18.07		

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* If gypsum be applied to land. † Near danger-line, especially for citrus trees. ‡ See sanitary analyses.

SPRING WATERS—*Continued.*

NOT SUITABLE FOR DOMESTIC OR IRRIGATION USES—*Continued.*

Locality.	County.	Sender.	Grains per Gallon.						
			Total Salts	Glauber Salt	Common Salt	Sal Soda	Lime Carbonate	Silica	Organic Matter
Coast Range—Continued.									
Antioch	Contra Costa	C. L. Barnham	198.07	43.81	28.45	113.31	2.22	.58	9.70
Martinez	Contra Costa	L. M. Tasell	1665.25	113.39	1420.61	37.08	.87	1.74	91.56
Evergreen	Santa Clara	Thomas Casaligno	41.98		chiefly		16.91		
Mountain View	Santa Clara	P. E. Simmens	122.00	chiefly					
Saratoga	Santa Clara	P. J. G. Kenna	100.30		chiefly				
Soquel No. 3	Santa Cruz	R. Lathrop	380.83	172.42	124.12	3.10	17.52	60.75	2.92
Santa Cruz	Santa Cruz	Whitney Bros.	59.47				26.82		
San Ardo	Monterey	Justin Gonta	133.17	72.22	13.55	1.26	29.21	.87	16.06
	San Benito	Edward Stearns	126.53				5.25		
San Miguel	San Luis Obispo	J. H. Von Schroeder	396.32	106.06	267.34	2.47	9.93	1.17	9.35
Southern California.									
Ventura	Ventura	F. Fazio	63.57	trace	32.25	1.23	16.28	2.15	11.66
Ventura	Ventura	J. T. Stockton	252.33	50.70	44.33	115.13	21.61	5.84	14.72
Bishop	Inyo	S. E. Vermilyea	148.94	67.77	34.78	30.33	4.09	7.88	4.09

COMMON WELL WATERS.

The number of waters from ordinary wells that have been sent for examination reach 155, and come from almost every part of the State. In the accompanying tables they are grouped according to suitability for domestic or irrigation uses, and also with regard to the several agricultural regions. There are also quite a number which, while suitable for irrigation, contain too much of glauber salt, etc., for domestic use; these are placed in a group to themselves.

Water Suitable for any Use.—A remarkably pure water to have come from a well is one from Colfax, Placer County, with but 2.6 grains of total salts per gallon. There are several others from the San Joaquin Valley which have but 5 or 6 grains per gallon, and this from a region where we would naturally anticipate finding more, because of the alkali of a large part of the valley.

Waters Suitable for Irrigation, but Unsuitable for Domestic Use.—Twenty-four of the waters, while suitable for irrigation purposes, contain too high an amount of glauber and other alkali salts for domestic use. Some of them are also hard in character, from the presence of quite an amount of lime. Nine others belong to the doubtful class for irrigation.

Unsuitable for Use.—Of the forty-five waters considered too highly charged with mineral salts for any use, there are thirty in which the amount of total salts is above 100 grains per gallon. The most noteworthy is that from Santa Barbara County, with its 1,327 grains, the greater part of which is sulfate. There are two wells in Contra Costa County, one of which is 200 feet deep, with 836 and 758 grains respectively, chiefly of common salt. Another from Bakersfield, with a depth of 1,000 feet, contained 558 grains, chiefly common salt, but also with 102 grains of carbonate of soda.

COMMON WELL WATERS.

SUITABLE FOR DOMESTIC AND IRRIGATION USES.

Locality.	County.	Sender.	Depth, in Feet	Grains per Gallon.						
				Total Salts	Glauber Salt	Common Salt	Sal Soda	Lime Carbonate, etc.	Silica	Organic Matter
Foothill Region.										
Biggs (No. 1)	Butte	J. M. Coffman	90	18.10	2.86	.68	2.47	5.67	4.67	1.75
Biggs (No. 2)	Butte	J. M. Coffman	30	16.94	4.51	.68	1.24	5.55	3.50	1.46
Biggs	Butte	G. K. Smith	30	27.74	2.75	.68	1.24	10.51	5.55	7.01
Mining Camp	Nevada	P. Fee	----	21.31	5.67	.68	1.24	12.56	.58	.58
Fall River Mills (No. 1)	Shasta	J. McArthur	----	32.41	7.54	2.05	.62	12.27	4.09	5.84
Fall River Mills (No. 2)	Shasta	J. McArthur	----	16.65	4.25	.68	.91	4.09	2.92	3.80
Colfax	Placer	J. H. Kneeland	----	*2.62	----	.16	----	----	----	----
Sacramento Valley.										
Florin (Enterprise School District)	Sacramento	Miss A. Jackman	----	*9.63	2.54	.34	.62	2.33	2.05	1.75
Taylor Island	Sacramento	H. Voorman	56	12.55	.16	.68	.62	2.92	3.50	4.67
Elk Grove	Sacramento	Paul L. Boyd	----	20.73	3.08	.62	1.85	8.47	2.92	3.79
Elk Grove	Sacramento	Paul L. Boyd	150	11.68	.16	.68	.62	4.09	3.21	2.92
Whitmore	Shasta	Miss Alice Dailey	----	7.00	.26	.62	----	1.16	3.50	1.46
Woodland	Yolo	G. H. Hecke	----	27.30	----	1.35	7.41	12.53	.76	5.25
Rumsey	Yolo	G. E. Fletcher	----	29.15	----	----	----	----	----	----
Durham	Butte	W. W. Durham	----	17.49	----	----	----	4.08	----	----
Maxwell	Colusa	H. Kraft	----	32.70	12.10	5.44	.74	8.87	2.80	2.75
Selma	Fresno	W. F. Martin	----	*11.68	----	.43	----	----	----	----
Selma	Fresno	Selma Water Co.	----	*5.90	----	.10	----	----	----	----
Selma	Fresno	Selma Water Co.	----	*6.62	----	.38	----	----	----	----
San Joaquin Valley.										
Fowler	Fresno	Thomas Akin	58	11.10	2.17	.68	1.24	4.67	1.17	1.17
Pollasky	Fresno	Nellie Russell	----	6.13	----	----	----	----	----	----
Fresno	Fresno	M. W. Moody	----	5.82	1.16	----	----	1.16	1.75	1.75
Kings River	Fresno	T. Yost	----	5.25	----	----	----	----	----	----
Bouldin	San Joaquin	R. Hickmott	----	16.32	4.38	1.35	1.26	3.79	3.21	2.33
Stockton	San Joaquin	Hammond & Yardley	----	35.04	7.55	2.73	2.57	12.27	3.50	6.42
Stockton	San Joaquin	J. M. Bigger	----	11.66	chiefly	----	----	----	----	----

Porterville	Tulare	J. W. Williams	115	22.72	7.44	2.70	6.18	1.74	2.33	2.33
Lindsay	Tulare	Dr. Pierce		30.95	4.66	2.73	3.71	8.17	4.38	7.30
Lodi	San Joaquin	Wm. H. DeVris	20	24.77				7.28		3.79
Coast Range.										
North Berkeley	Alameda	H. H. Postin	69	33.00	7.83	1.36	3.09	14.89	.87	4.96
Berkeley	Alameda	R. Flint		*27.74		9.55				
Berkeley	Alameda	D. Smith	55	*24.83	8.41	1.36	3.08	9.35	.88	1.75
Pleasanton	Alameda	W. H. Cope, M.D.		*28.90		5.22				
Oakland (old well)	Alameda	Wm. Rutherford		26.83	9.69	4.05	1.26	5.83	2.91	3.09
Oakland (new well)	Alameda	Wm. Rutherford		16.33	5.02	1.35	.63	3.50	2.33	3.50
Oakland	Alameda	M. Requa		31.49	consid.	consid.	small	med.	small	
Monterey	Monterey	D. Jacks		20.97	3.70	4.05	.99	8.74		3.49
Monterey	Monterey	B. Bienenfeld		10.22	5.26			2.92	.29	1.75
Hollister	San Benito	W. Griffeth		35.63	9.30	.68	1.24	17.98	3.51	2.92
San Francisco	San Francisco	A. Rogers		22.49	1.85	.68	1.85	14.02	.88	3.21
Menlo	San Mateo	T. Hopkins	300	28.44	9.36	4.77	1.23	10.92	.58	1.58
Menlo	San Mateo	T. Hopkins	400	26.46	5.73	1.36	3.71	12.85	2.05	.76
Menlo	San Mateo	C. W. Smith		*12.26		.20				
Colma (No. 1)	San Mateo	R. A. Gray		8.47	.71	.68	1.24	3.21	1.17	1.46
Colma (No. 2)	San Mateo	R. A. Gray		19.85	1.11	.68	4.34	9.93	1.75	2.04
Los Gatos	Santa Clara	G. W. Hume	30	20.85	3.31	.68	1.85	10.51	1.29	3.21
Los Gatos	Santa Clara	A. S. King		9.05	2.33			4.40	1.16	1.16
Palo Alto	Santa Clara	Mrs. Tucker		18.69	9.43	.68	4.49	1.75	1.17	1.17
San José (No. 1)	Santa Clara	G. K. McDonald		18.69	2.66	1.36	1.24	9.93	1.16	2.34
San José (No. 2)	Santa Clara	G. K. McDonald		17.23	3.34	.68	1.24	7.30	1.75	2.92
San José (No. 3)	Santa Clara	G. K. McDonald		20.15	5.67	.68	1.24	9.05	2.34	1.17
Lick Observatory	Santa Clara	Director		*6.41		.20				
Watsonville	Santa Cruz	L. Bridges		19.56	3.56	.68	2.47	9.93	.58	2.34
Watsonville	Santa Cruz	L. Bridges		17.81	1.82	1.36	.62	9.93	.87	3.21
Santa Rosa	Sonoma	H. L. Jones		23.32	small	small	trace	11.66		black
Southern California.										
La Cañada	Los Angeles	C. J. Newcomb	255	13.43	.38	.68	1.86	4.67	3.50	2.34
Moneta	Los Angeles	J. J. Dean	177	19.86	1.12	3.41	2.48	9.35	3.50	
Los Angeles	Los Angeles	Chamber of Com.		14.89	.33	1.36	6.19	1.87	1.34	3.80
Los Angeles	Los Angeles	B. F. Hand		*23.14		.42				
Pasadena	Los Angeles	F. A. Beeker		9.03	.38	1.34	.61	4.95	1.17	.58
Pomona	Los Angeles	A. W. Wright	294	10.49						
Duarte	Los Angeles	W. W. Bliss		19.97	3.70	trace	1.26	9.52	1.11	4.38
La Mirada	Los Angeles	Louis Blatz		10.49						
Anaheim	Orange	J. B. Neff		19.24	2.45	1.35	3.78	7.00	1.74	2.92
Perris	Riverside	Hook Bros.	100	29.74	3.04	6.76	1.86	8.45	3.21	6.42

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*See sanitary analyses.

COMMON WELL WATERS—*Continued.*

SUITABLE FOR DOMESTIC AND IRRIGATION USES—*Continued.*

Locality.	County.	Sender.	Depth, in Feet	Grains per Gallon.						
				Total Salts	Glauber Salt	Common Salt	Sal Soda	Lime Carbonate, etc.	Silica	Organic Matter
Southern California—Continued.										
San Timoteo Cañon	Riverside	E. M. Izard		32.42	9.35	6.14	4.95	8.76	.88	2.34
Corona	Riverside	S. W. Lockett		27.10	4.10	5.07	.74	9.62	3.20	4.37
Corona	Riverside	S. W. Lockett		31.48	9.99	3.38	62	9.91	3.49	4.09
Corona	Riverside	Water Co.		26.30		8.10	1.70	9 80	3.79	2.91
Redlands	San Bernardino	M. Sherman		19.86	2.14	.68	1.85	6.43	2.04	6.72
Redlands	San Bernardino	C. M. Baxter	100	46.64	8.01	.68	2.97	23.32		11.66
Pomona	San Bernardino	10 A. Tract, Exp. Sta.		26.24	5.06	1.35	3.09	11.91	.58	4.25
Pomona	San Bernardino	Expt. Station		20.04	2.05	1.74	2.04	8.79	3.09	2.33
Pomona	San Bernardino	Expt. Station		18.29	2.58	.81	2.44	9.50	1.86	1.10
Highland	San Bernardino	C.H. Browning, M.D.		*15.16		1.02				
San Diego	San Diego	P. Remondino		*11.97	1.04	.68	.62	7.01	.58	2.04
Point Loma	San Diego	F. M. Pierce		20.33						2.79

UNSUITABLE FOR DOMESTIC, BUT SUITABLE FOR IRRIGATION PURPOSES.

Locality.	County.	Sender.	Depth, in Feet	Total Salts	Glauber Salt	Common Salt	Sal Soda	Lime Carbonate, etc.	Silica	Organic Matter
Fresno	Fresno	H. C. Eggers		45.85	17.59	8.85	2.48	7.42	6.30	3.21
Tulare	Tulare	H. Wheeler	136	32.07	20.26	6.76	1.26	2.04	.87	.88
Tulare	Tulare	H. Wheeler		38.61	29.72	.67	1.23	2.21	1.16	3.62
Sacramento	Sacramento	H. Stillman		56.59	22.82	.68	1.86	22.24	2.57	6.42
Berkeley	Alameda	L. Heaton		37.38	12.97	.68	1.24	17.53	4.38	.58
Fruitvale	Alameda	J. R. Wuescher		*28.33	13.54	.68	1.84	2.92	4.09	5.26
San Francisco	San Francisco	Mrs. L. Ferguson		60.75	18.73	.68	2.79	31.54	1.17	5.84
San Francisco	San Francisco	John Kolling		56.65	8.26	.62	3.09	31.83	2.04	10.81
Glenwood Station	Santa Cruz	C. H. Merrill		36.21	14.08	1.36	.62	14.16	1.46	4.09
Tres Pinos	San Benito	J. W. Carico		39.02	12.18	2.75	8.67	11.10	.58	3.74
Los Gatos	Santa Clara	H. C. Hodgeman		33.42	10.07	5.46	1.24	9.11	1.99	5.55
Santa Monica	Los Angeles	Experiment Station		47.22	19.82	4.05	.62	14.86	3.20	4.67
Santa Monica	Los Angeles	J. E. Hackett		45.48	22.30	1.28	.62	13.41	2.62	5.25
Perris	Riverside	Chase Nursery Co.		30.32	10.15	6 70	1.22	7.29		4.96

San Jacinto	Riverside	P. L. Griffin		19.23	11.31	.70	.23	6.99		
Lakeside	San Diego	F. C. Crowell	30	37.09	14.01	3.41	1.86	8.47	5.25	4.09
Santa Barbara	Santa Barbara	R. B. Fithean	428	28.91	10.21	1.36	1.86	10.81	2.63	2.04
Santa Paula	Ventura	T. W. Dobbins	80	45.09	18.54	1.00	.32	17.52	2.46	5.25
Santa Paula	Ventura	G. F. Norwalk		44.68	19.96	.68	1.85	16.64	1.17	4.38
Santa Paula	Ventura	W. A. Carney		37.61	21.67	4.05	3.73	4.37	2.92	.87
Santa Paula	Ventura	W. A. Carney		40.24	18.48	3.79	1.34	8.17	3.49	4.97
Nordhoff	Ventura	S. D. Thacker		40.30	18.52	.68	1.24	16.65	.29	2.92
Ventura	Ventura	Saticoy Water Co.		52.86	21.51	1.36	3.71	18.57	4.79	2.92
Redlands	San Bernardino	C. V. Bellen		33.82	13.43	1.36	5.04	7.58	3.50	2.91

Of Doubtful Suitability for Irrigation Use.

Pierson Tract	Sacramento	J. Van Loben Sels	190	43.44	12.48	**14.57	1.23	3.21	3.79	8.16
Taylor Island	Sacramento	H. Voorman	296	35.05	7.12	**15.00	1.24	7.89	2.34	1.46
Clements	San Joaquin	L. Friedberger		54.82	11.98	**12.17	2.68	9.92	2.62	15.45
Garlock	Kern			59.57	33.16	.68	.62	12.79	3.27	9.05
Hollister	San Benito	H. Pond		50.74	33.36	2.70	1.26	4.38	1.76	7.28
Ventura	Ventura	A. Fraser		71.15	32.08	2.72	2.52	18.66	2.93	12.24
Sespe	Ventura	S. Goodrich		58.44	24.35	2.71	2.10	18.66	.82	9.80
Los Angeles	Los Angeles	F. Wiggins		39.42	2.71	**12.38	1.85	16.35	.58	5.55
Santa Monica	Los Angeles	Expt. Station		71.60	32.68	2.71	.47	16.41	2.45	6.88

Not Suitable for Either Domestic or Irrigation Use.

Foothills.										
Rocklin	Placer	B. R. Woodworth		141.71	32.96	89.29	14.80	1.75	2.33	.58
Great Valley.										
Redding	Shasta	A. Dutton		427.55	trace	407.81	1.24	4.20	1.16	13.14
Bouldin Island	San Joaquin	R. Hickmott	110	75.06	1.25	54.20	3.27	9.34	2.04	4.96
Bouldin Island	San Joaquin	R. Hickmott		67.36	6.15	42.62	3.71	7.58	2.63	4.67
Clements	San Joaquin	L. Friedberger		63.56		chiefly		trace	small	
Madera	Madera	A. L. Gayre		140.01	.60	98.01	1.86	22.49	5.08	11.97
Los Baños	Merced	H. T. Thornton		461.64	im'nse	large		mostly	im'nse	slight
Mendota	Fresno	Isaac Myers		491.33				58.32		42.28
Angiola	Fresno	W. H. Wilbur	80	344.16				92.72		23.32
Angiola	Fresno	W. H. Wilbur	360	230.92				92.72		23.32
Bakersfield	Kern	J. S. Drury		258.46	167.19	.68	1.23	56.07	2.63	30.66
Bakersfield	Kern	D. E. Josephi	38	236.27	177.20	14.90	1.20	28.31	3.80	10.86
Bakersfield	Kern	Kern Co. Land Co.	1,000	558.21	60.90	373.04	102.58	10.20	1.57	9.92
McKittrick	Kern	C. F. Banks		338.24				99.14		29.16

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* See sanitary analyses.

** Near danger-line, especially for citrus fruits.

COMMON WELL WATERS—*Continued.*

NOT SUITABLE FOR EITHER DOMESTIC OR IRRIGATION USE—*Continued.*

Locality.	County.	Sender.	Depth, in Feet	Grains per Gallon.						
				Total Salts	Glauber Salt	Common Salt	Sal Soda	Lime Carbonate, etc.	Silica	Organic Matter
Coast Range.										
Sunol	Alameda	J. L. Weisbaumer		81.63				11.66		6.99
Haywards (3 miles east)	Alameda	J. Smith		54.82	20.07	17.61	2.10	10.49	1.46	3.09
Oakland	Alameda	Mrs. W. Rodulph		65.12	12.79	28.64	1.85	7.53	3.21	11.10
East Oakland	Alameda	George Lydikson		54.81		chiefly		19.82		
Miner's Ranch	Contra Costa		1,200	836.84	trace	765.31	7.39	3.49	2.33	58.32
Mt. Diablo	Contra Costa	H. J. Hostry		758.13			large	small	large	
Soledad	Monterey			129.08	53.87	26.60	2.47	42.64	2.63	.87
Monterey	Monterey	David Jacks		52.23	12.71	21.64	1.22	7.92		8.74
Monterey	Monterey	David Jacks		61.81	8.00	29.14	3.09	10.49		10.49
Hollister (Stoller well)	San Benito	H. Pond		106.43	65.34	2.84	15.80	13.41	1.75	7.29
San Juan	San Benito	W. W. Canfield		82.80		chiefly		large		
San Mateo	San Mateo	A. C. Potter		58.80		im'ense				
San Mateo	San Mateo	A. C. Potter		45.00	6.80	18.14	1.06	13.00	1.00	5.00
San Mateo	San Mateo	A. C. Potter	310	63.57	26.08	27.28	4.96	2.10	.23	2.92
Santa Cruz	Santa Cruz	Whitney Bros.	88	59.47				26.82		
Benicia	Solano	C. Egbert		75.81	34.07	25.36	9.27	3.50	1.75	1.86
Santa Maria	Santa Barbara	G. T. Goodwin		111.96	66.38		1.26	25.08	4.08	15.16
Garey	Santa Barbara	W. W. Gibson		428.63	236.65	29.20	3.70	95.53	4.07	59.48
Lompoc	Santa Barbara	J. W. Saunders		77.98	24.64	20.32	.67	19.45	4.03	8.87
Southern California.										
Coronadel Ranch	Santa Barbara	T. B. Bishop		100.89	42.16	18.97	1.26	23.33	2.34	12.83
Corona Del Mar (No. 2)	Santa Barbara	T. B. Bishop		128.79	16.49	69.56	1.86	24.24	1.46	15.18
Corona Del Mar (No. 3)	Santa Barbara	T. B. Bishop		291.46	152.75	27.96	1.24	95.49	5.55	8.47
Santa Barbara	Santa Barbara	W. W. Berton		1327.37	1017.66		4.95	132.73	2.91	169.12
Casmalia Rancho	Santa Barbara	Oil Devel. Co.		223.93				5.83		13.99
Santa Paula	Ventura	Dr. Dobbins	216	286.57	216.76	6.77	2.97	60.07		
Buckhorn	Ventura	F. H. Paddleford		173.21	109.30	1.34	3.09	31.78	4.37	23.33
Forty miles east of Ventura	Ventura	E. E. Hall	475	58.31				15.16		
Long Beach	Los Angeles	E. E. Moore		82.76	3.82	49.78	12.99	9.64	5.95	.58
La Mirada	Los Angeles	Louis Blatz		43.15		chiefly		small	small	
Pomona	Los Angeles	A. W. Wright	294	10.49						
Lang	Los Angeles	I. Youngblood		551.09	trace	mostly		medium	small	

WATERS OF ARTESIAN WELLS.

There were nineteen waters of artesian wells received, and of these fourteen were found to be suitable for both domestic and irrigation uses. An exception should perhaps be made of that from Piru City, in which there were 14 grains of sulfates, which might prove too severe for some persons; but otherwise the water is unobjectionable.

One of the waters from Eltoro, Orange County, contains a very large amount of sulfates, which renders it purely medicinal in nature. (See table of analyses on p. 228.)

WATERS OF RESERVOIRS AND IRRIGATION DITCHES.

Of the twenty-four reservoir waters, fourteen were found to contain so little mineral matter as to be fit for use, except that several were so highly charged with lime carbonate as to be "hard" in character. Among those in the group of "unsuitable" waters there are three which may be used for irrigation purposes though not for domestic use—viz.: the Corona water sent by J. M. Howard, and those from Santa Monica and the Soldiers' Home. The others are to be condemned for either purpose. (See table of analyses on p. 229.)

SANITARY EXAMINATIONS.

The waters for which a sanitary examination was requested to ascertain whether or not they were contaminated and unfit for domestic use were seventeen, and chiefly from ordinary wells. They were all found to be fit for use, with the exception of two from San Mateo County, which contained so much free and albuminoid ammonia as to clearly show dangerous sewage contamination. (See table of analyses on p. 230.)

WATERS FROM ARTESIAN WELLS.

Locality.	County.	Sender.	Depth, in Feet	Grains per Gallon.						
				Total Salts	Glauber Salt	Common Salt	Sal Soda	Lime Carbonate	Silica	Organic Matter
SUITABLE FOR DOMESTIC AND IRRIGATION USES.										
Semi-Tropic	Kern	J. J. McCarthy		12.26	2.80	.68	2.47	2.63	1.34	2.34
Tulare	Tulare			6.71	1.23	.68	2.47	1.17	.58	.58
Pleasanton	Alameda	Dr. W. H. Cope		28.90	2.04	8.54	10.15	6.13		2.04
Milpitas	Santa Clara	A. K. Whitton		28.62	4.35	1.36	2.47	14.60	.58	5.26
Alviso	Santa Clara	M. Burke		23.32				8.16		
Los Angeles	Los Angeles	F. Wiggins		16.64	3.60	1.37	4.96	4.09	.58	2.04
Los Angeles	Los Angeles	F. Wiggins		16.62	8.10	1.35	2.52	1.45	.58	2.62
Lancaster	Los Angeles	S. Storey		16.93	1.10	1.36	4.95	4.96	1.75	2.81
Lancaster	Los Angeles	M. R. Lyle		9.91	2.80	.67	2.71	2.04	.93	.76
Compton	Los Angeles	C. L. Wright	398	20.44	2.94	1.34	2.43	9.92	1.48	2.33
Whittier	Los Angeles	H. W. R. Strong		4.26	small	chiefly	med'm			
Corona	Riverside	J. M. Howard	pipe line	16.23	6.97	.64	1.85	3.80	.52	2.45
San Jacinto	Riverside	H. K. Smith		10.48				1.16		3.49
Piru City	Ventura	A. B. Lucas		26.86	14.36	.68	2.48	6.13	.58	2.63
DOUBTFUL FOR IRRIGATION USE.										
Eltoro	Orange	G. Baum	40	94.61	64.63	**13.64	4.96	7.30	2.04	2.04
Fullerton	Orange	L. B. Benchley	305	71.14	40.59	5.41	1.82	13.42	1.45	8.45
NOT SUITABLE FOR DOMESTIC USE.										
Gridley	Kings	H. Cook		179.90	29.65	48.42	34.66	47.02	2.34	17.81
Compton	Los Angeles	Dr. E. Densmore		87 62	16.82	42.64	12.38	7.89	2.05	5.84
Eltoro	Orange	G. Baum	40	614.77	412.16	7.50	5.57	138.43	2.34	48.77

WATERS FROM RESERVOIRS AND IRRIGATION DITCHES.

Locality.	County.	Sender.	Taken from.	Grains per Gallon.						
				Total Salts.	Glauber Salt	Common Salt	Sal Soda	Lime Carbonate	Silica	Organic Matter
Suitable for Irrigation.										
Sites	Colusa	McGilvray Co.		20.39				9.03		2.33
Yountville	Napa	— Scoville		6.41	.21	.20	1.05	3.61		1.34
Mining Camp	Nevada	P. Fee		18.39	6.81	.68	1.86	7.00	1.46	.58
Hanford	Kings	N. W. Motheral		42.97	7.70	9.67	2.46	13.99	3.61	5.54
Selma	Fresno	W. F. Martin		11.61		.43				
Menlo Park	San Mateo	C. W. Smith	reserv.	18.11	4.74	1.36	.62	5.26	2.04	4.09
Menlo Park	San Mateo	C. W. Smith	reserv.	12.26	1.94	.34	1.24	6.30	1.16	1.28
Los Gatos	Santa Clara	J. A. Schofield		53.64				31.49		11.66
Soldiers' Home	Los Angeles			36.73	13.93	8.75	.35	9.62	1.46	2.62
Glendora	Los Angeles	C. C. Warren	hydt.	16.35	2.42	.68	1.86	4.09	4.96	2.34
Glendora	Los Angeles	C. C. Warren	tunnel	15.77	2.50	.68	.62	4.09	6.13	1.75
Chino	San Bernardino	Beet Sugar Co.		23.89	5.78	2.70	.85	6.41	3.49	4.66
Chino	San Bernardino	Beet Sugar Co.		17.65	4.41	.67	3.21	5.93	.87	2.56
Chino	San Bernardino	Beet Sugar Co.		18.93	3.80	1.34	1.70	8.89	1.16	2.04
Doubtful for Irrigation Use.										
Corona	Riverside	J. M. Howard	cañon	41.88	17.71	3.92	1.85	11.86	1.28	5.26
Piru City	Ventura	C. M. Davis		75.81		small	small			
Santa Monica	Los Angeles			47.22	19.82	4.05	.62	14.86	3.20	4.67
Not Suitable for Irrigation.										
Colusa	Colusa	G. D. Metcalf		1,749.53				3.49		81.65
Corona	Riverside	A. M. Phillips		76.10	10.41	37.87	2.46	15.16	3.79	6.41
Stalder	Riverside	A. J. Stalder		196.54	18.26	110.07	3.09	35.34	.58	29.20
Fillmore	Ventura	F. C. Grimes		487.73	384.60	8.84	4.92	61.62	3.80	23.95
El Rio	Ventura	G. E. More		99.88	64.37	4.09	3.09	19.69	.46	8.18
Piru City	Ventura	C. M. Davis		109.04	abund.	small	small	med.	small	slight
Piru City	Ventura	C. M. Davis		176.44	abund.	consid.	small	med.	small	slight

SANITARY EXAMINATION OF WATERS.

Locality.	County.	Sender.	Source	Grains per Gallon.		Parts per Million.			
						Ammonia.			
				Total Residue	Chlorids	Free	Albuminoid	Oxygen Consumed in Moist Combustion	Nitrates
Suitable for Domestic Use.									
Lick Observatory	Santa Clara	......	well	6.41	.20	.05	.164	1.20	......
San Anselmo	Marin	Presbyterian Orph'ge	spring	10.50	.35	.030	.090	.960	......
Berkeley	Alameda	D. Smith	well	24.83	.83	.07	.04	.60	......
Fruitvale	Alameda	J. R. Wuescher	well	28.33	.41	.072	.12	.60	......
Pleasanton	Alameda	Dr. W. H. Cope	well	28.90	5.22	......	.074	2.75	none
North Berkeley	Alameda	R. Flint	well	27.74	9.55	.044	.064	1.64	small
Selma	Fresno	W. T. Martin	well	11.68	.43	.106	.052	1.28	......
Selma (tank)	Fresno	W. T. Martin	well	11.61	.43	.078	.110	1.20	......
Selma	Fresno	Selma Water Co.	well	5.90	.10	.02	.034	.69	1.50
Selma	Fresno	Selma Water Co.	well	6.62	.38	.016	.018	.92	2.00
Colfax	Placer	J. H. Kneeland	well	2.62	.16	.034	.066	1.38	......
Los Angeles	Los Angeles	B. F. Hand	well	23.14	.42	.013	.090	1.20	......
Florin	Sacramento	Miss A. Jackman	well	9.63	.20	.056	.066	.025	......
Highland	San Bernardino	C. H. Browning, M.D.	well	15.16	1.015	.074	.108	.95	trace
San Diego	San Diego	P. Remondino	well	11.97	.68	.052	.06	1.00	......
Not Suitable for Domestic Use.									
Menlo Park	San Mateo	C. W. Smith	well	12.26	.20	.56	.82	7.40	......
Menlo Park	San Mateo	C. W. Smith	reserv'ir	18.11	1.85	1.4	.522	5.5	traces

FOODS, FEEDING-STUFFS, AND SUGAR-BEETS.

By M. E. Jaffa.

A STUDY OF SOME CALIFORNIA BUTTERS MADE FOR EXPORT.

This investigation was undertaken at the request of the U. S. Department of Agriculture, for the purpose of ascertaining the quality of butter produced from milk of cows whose food consisted largely of sugar-beet pulp silage.

The dairy was situated at Alvarado, Alameda County, adjacent to the beet-sugar factory. The milk was hauled daily to Oakland, a distance of 24 miles, where the butter was made at a well-equipped creamery. The food of the cows consisted of sugar-beet pulp silage, mixed hay, and mixed feed. The analyses of these fodders are given in the subjoined table.

Table I. Analyses of California Butters.

Percentage Composition.

	Sugar-beet Pulp Silage.	Mixed Hay.	Mixed Feed.
Water	86.60	7.65	10.61
Ash	.59	5.91	3.31
Protein	2.02	7.30	11.69
Fiber	5.32	24.80	9.90
Starch, etc.	5.27	51.59	60.69
Fat	.20	2.75	3.80
Totals	100.00	100.00	100.00
Amount Digestible in 100 Pounds.			
Protein	1.82	4.38	9.32
Fat	.18	1.65	2.66
Fiber	4.26	11.16	2.47
Starch, etc.	4.74	36.11	45.51
Fuel value per pound (calories)	209	1028	1160
Nutritive ratio	1:5	1:12	1:5.7

The ration was compounded as follows:

	Dry Matter.	Protein.	Fat.	Carbohydrates.
	lbs.	*lbs.*	*lbs.*	*lbs.*
60 lbs. sugar-beet pulp silage	8.04	1.08	.11	5.40
10 lbs. mixed hay	9.23	.44	.17	4.73
5 lbs. mixed feed	4.50	.47	.14	2.39
Totals	21.77	1.99	.42	12.52

This ration, while conforming to the standard for milch cows (of 1,000 pounds live weight) in fat and carbohydrates, is deficient in protein and total dry matter. The animals were not large, apparently thrived, and the milk yield was fairly satisfactory.

The opinion is maintained by some that the butter thus produced would be softer than the ordinarily made article, while there are others who hold entirely to the opposite view.

It is a generally admitted fact that sugar-beet tops when used as feed tend to the production of "hard" butter. In this investigation no tops were fed, on account of the bitter taste imparted to the milk, part of which was used for butter-making as above outlined, and part for consumption, as such, in San Francisco. Previous to the butter-making trial, the tops were at one time fed, but the practice had to be discontinued, owing to complaints from consumers regarding the unpleasant taste of the milk.

Our investigation on the California butters comprised the analyses of six samples from different day's runs, August 18th to 23d, 1899, inclusive.

Two of the specimens were from the lots made from cream ripened with buttermilk as a "starter," and four from cream ripened with the aid of "B. 41."

The composition of the butters, together with other interesting data, is presented in the following tables:

TABLE II. DATA RELATING TO THE MANUFACTURE OF THE DIFFERENT LOTS OF BUTTER.

	1	2	3	4	5	6
Date of manufacture, 1899	Aug. 18.	Aug. 19.	Aug. 20.	Aug. 21.	Aug. 22.	Aug. 23.
Weight of milk, pounds	594	594	594	594	594	594
Weight of cream, pounds	65	58	56	58	60	55
Fat, per cent in milk	4.0	3.7	3.7	3.8	3.8	3.6
Fat, per cent in cream	30.0	35.0	36.0	35.0	34.0	36.0
Fat, per cent in skim milk	0.1	0.1	0.1	0.1	0.1	0.1
Overrun of milk, per cent	10.0	13.5	13.0	10.0	6.0	7.5
Overrun of cream, per cent	22.0	23.0	24.0	23.0	17.0	16.0
Temperature of milk at separation, degrees Fahr.	78	78	80	80	82	80
Temperature of room at separation, degrees Fahr.	66	67	67	67	67	70
Temperature of cream when separated, degrees Fahr.	78	78	80	80	82	80
Temperature of ripening of cream, degrees Fahr.	63	60	60° for 23 hrs., 50° for 23 hrs.	77° for 33 hrs., 50° for 12 hrs.	60	58
Starter used	butterm'k	butterm'k	"B. 41"	"B. 41"	"B. 41"	"B 41"
Time of ripening of cream, hours	19	20	46	45	24	24
Temperature of cream at churning, degrees Fahr.	56	52	52	52	58	52
Time of churning, minutes	42	40	45	45	35	50
Fat, per cent in buttermilk	0.2	0.4	0.2	0.15	0.2	0.2
Acidity of cream at churning, per cent	.6	.6	.6	.63	.6	.6
Weight of butter, pounds	24	25	25	25	24	23

TABLE III. COMPOSITION OF BUTTERS.

A. General Analyses.

	1	2	3	4	5	6	Average of the Six Samples.	Average of Twelve Analyses.
Date of making	Aug. 18	Aug. 19	Aug. 20	Aug. 21	Aug. 22	Aug. 23		
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.**
Water	10.60	11.50	10.44	9.48	11.07	10.52	10.60	10.97
Fat	86.46	87.17	85.97	87.27	86.10	86.91	86.32	84.60
Curd, etc.	1.31	1.24	1.29	1.23	1.33	1.24	1.27	1.24
Salt	1.47	1.93	2.08	1.83	1.31	1.22	1.64	3.19
Other mineral matter	.16	.16	.22	.19	.19	.11	.17	
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

B. Analyses of Butterfat.

Butyrin	6.81	6.20	6.67	6.33	6.10	6.20	6.39	---- ----
Palmitin, stearin, etc.	55.45	54.50	55.83	55.12	56.28	56.92	55.68	---------
Olein	37.74	39.30	37.50	38.55	37.62	36.88	37.93	---------
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	---------
Melting point, degrees C.	32.8	32.8	32.5	32.5	32.5	32.9	32.7	---------
Refractive index at 25° C.	1.4604	1.4604	1.4594	1.4602	1.4592	1.4594	1.4598	---------

A comparison of the two averages given in Table III shows that the main difference lies in the salt content. The maximum for this ingredient in the six samples, 2.08 per cent, is found in No. 3, and the minimum, 1.22 per cent, in No. 6, with an average of 1.64 per cent. The corresponding figure for the earlier work is 3.19.

The ratings in casein, etc., 1.27 and 1.24, are almost identical, and the percentages of water in the two averages show close agreement.

It will be noted that the mean of the determinations of fat, reported for the six specimens, 86.32 per cent, is 1.72 per cent higher than the earlier average, 84.60 per cent. The difference is about equal to that found between the two results obtained for salt.

It is thus seen from the above data that the butter herein reported compares very favorably with that made from milk of cows whose rations did not contain sugar-beet pulp silage.

One of the chief aims of making butter for export, particularly to tropical climates, is to secure as hard a product as possible.

This implies a butter with a high melting point and consequently with the maximum content of palmitin, stearin, etc. (solid at ordinary temperatures), and the minimum of olein.

Blyth† states the average composition of butterfat to be:

Olein	42.21
Palmitin, stearin, etc.	50.00
Butyrin, etc.	7.79
	100.00

Melting point, between 30° and 36° C.

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*Cal. Sta. Rep. 1895–97, p. 118. Inserted for comparison.

† Foods: Composition and analysis, 4th ed., p. 340.

It is seen from an examination of the analyses of butterfat ("B," Table III) that the maximum and minimum percentages of olein are respectively 39.30, noted for No. 2, and 36.88 for No. 6; the average for the six lots being 37.93 per cent for olein, 6.39 per cent for butyrin, and 55.68 per cent for palmitin, stearin, etc. These figures differ from the data given by Blyth, in that the California butters contain less olein and more palmitin, stearin, etc. This would seem to indicate that the home product was harder (i. e., had a higher melting point) than the average of foreign manufacture—a statement, however, not borne out by a study of the results obtained from the analyses* of foreign-made butters by the Division of Chemistry, U. S. Department of Agriculture, in which the maximum melting point, as obtained from 28 analyses, was 36° C.; the minimum, 31.6° C.; with an average of 34° C. The corresponding figures for California are 32.9° C.; 32.5° C., and 32.7° C.

An inspection of the results presented in Table IV, showing the comparison of average of foreign and domestic butters, brings to light some interesting data. The Eastern and foreign butters contain more water than those made in California. This is evidenced by the average, 10.60 per cent for the latter, given in the table, and also by the figures, 10.47 per cent, obtained in a former investigation.†

TABLE IV. ANALYSES OF FOREIGN AND DOMESTIC BUTTERS.

Where Made.	Water	Fat	Casein, etc.	Salt	Total Ash	Melting Point	Insoluble Acids.		Soluble Acids.
							Palmitic, etc.	Olein	
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Deg. C.*	*Per ct.*		*Per ct.*
Average from 28 foreign countries	13.22	83.75	1.14	1.70	1.89	34.0	88.79		5.50
Wisconsin	12.88	84.28	1.05	1.76	1.79	34.5	88.55		5.50
Wisconsin	13.08	82.96	.94	2.97	3.02	35.0	88.46		5.42
Minnesota	13.57	84.32	.78	1.22	1.33	34.5	88.87		5.30
Minnesota	13.21	84.68	.93	1.11	1.18	34.5	88.79		5.33
California	10.60	86.32	1.27	1.64	1.81	32.7	88.35		5.58

The amount of salt found in the California article is about the same as that noted for the other butters in question. A marked difference is seen, however, in the percentage of casein, etc., as indicated in the analyses presented in the table. California rates the highest, with 1.27 per cent, and Minnesota the lowest, with .78 per cent.

Cæteris paribus, it is generally supposed that the keeping qualities of butter vary directly as the casein content. There is not sufficient variation in the figures for the insoluble and soluble acids of the different butters to warrant comment.

Conclusion.—The tentative conclusion to be drawn from the above analyses and discussion is that sugar-beet pulp silage, when largely fed to milch cows, does not result in the production of a "hard" butter, but has a slight tendency to soften the butter made from the milk of animals so fed.

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*Sixteenth Annual Report, Bureau of Animal Industry, p. 242.

† California Station Report, 1895-97, p. 118.

MISCELLANEOUS ANALYSES.

Gluten Flour.—Two samples of gluten flour, furnished by Miss Jewett, of Berkeley, were analyzed, as follows:

	Ralston.	Goldberg & Bowen.
Water	14.40%	12.65%
Ash	.50	1.02
Protein (gluten, etc.)	14.00	20.00
Fiber	.60	1.00
Starch, etc.	69.00	62.68
Fat	1.50	2.65
Totals	100.00	100.00
Fuel value of one pound (calories)	1528	1688
Nutritive ratio	1:5.2	1:3.4

The above figures prove conclusively the superiority of the Goldberg & Bowen sample, which contains nearly 50 per cent more gluten than does the Ralston specimen.

Wheat and Wheatine.—Analyses were made of samples of wheat and wheatine, sent by the Empire Milling Company, of San Francisco.

The substances as they stand contain:

	Wheat.	Wheatine.
Water	11.22%	13.00%
Ash	1.13	1.04
Protein	12.00	12.25
Fat	2.10	2.08
Fiber	2.30	1.30
Starch, etc.	71.25	70.33
Totals	100.00	100.00

In order to better compare these results, they are presented below on a *water-free* basis:

	Wheat.	Wheatine.
Protein	13.51%	14.08%
Ash	1.27	1.20
Fat	2.36	2.39
Fiber	2.60	1.49
Starch, etc.	80.26	80.84
Totals	100.00	100.00

An examination of the above figures shows that the nourishing properties are slightly increased in being converted to wheatine.

The smaller percentage of fiber noted for the wheatine is certainly an advantage in most cases, especially for young children.

Fruit-Preserving Liquid.—Analysis of fruit-preserving liquid furnished by J. A. Filcher, Secretary and Manager of the California State Board of Trade, San Francisco. The liquid contains:

Glycerine	2.569%
Formaldehyde	.380
Sulphurous acid	.010
Acetic acid	.036
Ash (mineral residue)	.210
Water, etc.	96.795
Total	100.000

Specific gravity of liquid, 1.0120.

Equivalent to about one per cent commercial formalin.

Peat.—A sample of peat, sent by Meyer, Wilson & Co., San Francisco, was examined, with the following result:

Proximate Analysis.

Water	18.40%
Organic matter	69.61
Ash	11.99
Total	100.00

Partial Chemical Analysis.

	Fresh.	Water-free.
Water	18.40%	----
Total nitrogen	.68	.84%
Total phosphoric acid	.26	.32
Potash (K_2O) soluble in water	.40	.49

Reaction: slightly acid.

Yadoo Fiber, from the museum of College of Agriculture:

Proximate Analysis.

Water	10.00%
Organic matter	86.00
Ash	4.00
Total	100.00

Partial Chemical Analysis.

Water	10.00%
Total nitrogen	.84
Total phosphoric acid	.50
Potash (K_2O) soluble in water	.21
Lime (CaO) soluble in hydrochloric acid	.75
Iron (Fe_2O_3) and alumina (Al_2O_3)	.90
Insoluble residue	.79

Meat Meal and Blood Meal.—Samples of meat meal and blood meal, sent by Robert Robertson, of Yountville, Cal., were analyzed. The materials contain:

	Meat Meal.	Blood Meal.
Moisture	4.72%	8.68%
Ash	46.15	4.95
Protein	29.68	78.75
Fat	12.57	1.00
Crude fiber	3.05	2.36
Starch, etc.	3.83	4.26
Total	100.00	100.00

For poultry-feeding the blood meal is the more valuable, on account of its higher rating in protein, *the only ingredient* which should be considered when purchasing concentrated poultry foods. But the pecuniary economy must not be forgotten, If the meat meal could be sold at a proportionately lower price (taking the protein as a basis) than the blood meal, it would be equally as valuable for laying-hens.

Fish Refuse.—A sample of fish refuse, sent by C. Nisson, of Petaluma, Cal., was examined. The substance contains:

Organic matter and water	76.98%
Inorganic matter (ash)	23.02
Nitrogen	6.68
Crude protein	41 80
Total phosphoric acid	3.84

ANALYSES OF SUGAR-BEETS.

The results of the examination of the samples of sugar-beets received during 1898–1900 are shown in the appended tables and discussions. Credit is due Mr. F. J. Snow for assistance in the analytical work.

TEHAMA COUNTY.

SEASON OF 1898.

Nos. 434 and 446. Sugar-beets from Cone Ranch; sent by Mr. Homer Wilson, Mills Building, San Francisco. No. 434 arrived at the laboratory in good condition, August 17th. No. 446 was received October 26th, considerably wilted.

No. 445. Sugar-beets from Tehama; grown by John Finnell; sent by George E. Goodman, Napa. Received at the laboratory, slightly wilted, October 18th.

SEASON OF 1899.

Nos. 450, 452, 453, 454, 458. Sugar-beets from Tehama; grown by John Finnell; sent by George E. Goodman, Napa. Received at the laboratory in good condition, as follows: No. 450, September 1st; Nos. 452, 453, and 454, October 4th; No. 458, October 27th.

SEASON OF 1900.

Nos. 461, 462, 463. Sugar-beets from Tehama; grown by John Finnell; sent by George E. Goodman, Napa. No. 461 was received in good condition on July 10th, having been harvested July 6th. Nos. 462 and 463 were received at the laboratory on August 14th and October 6th respectively; corresponding dates of harvesting were August 12th and October 4th.

No.	Variety.	Average Weight of One Beet	Specific Gravity of Juice	Solid Contents, by Spindle	Cane Sugar	Purity Coefficient	Ash in Juice
	Season of 1898.	*Grams.*		*Per ct.*	*Per ct.*		*Per ct.*
434	Kleinwanzlebner	637	1.0841	20.21	16.39	81.13	.94
445	Kleinwanzlebner	450	1.0650	15.9	11.44	71.84	.81
446	Kleinwanzlebner	301	1.0740	17.90	15.19	84.86	.84
	Season of 1899.						
450	Kleinwanzlebner	743	1.0785	18.90	16.47	87.15	.92
452	Kleinwanzlebner	823	1.0747	19.20	16.99	88.49	.88
453	Kleinwanzlebner	501	1.0837	20.10	18.40	91.49	.64
454	Kleinwanzlebner	663	1.0855	20.50	17.70	86.37	.87
458	Kleinwanzlebner	680	1.0779	18.80	15.76	83.92	.63
	Season of 1900.						
461	Kleinwanzlebner	231	1.0757	18.30	13.99	75.45	1.17
462	Kleinwanzlebner	674	1.0781	18.80	15.84	84.25	1.00
463	Kleinwanzlebner	713	1.0722	17.50	14.96	85.49	.86

Of the crop for 1898, Nos. 434 and 446 are desirable beets, although the latter is undersized. No. 445 represents a low-grade root.

That for 1899 is a most excellent showing. The beets are very rich in sugar, and the purity coefficients are correspondingly high. They are of the proper size and represent a very desirable crop. It will be noted, however, that No. 458, harvested late in October, rates the lowest in respect to sugar content and purity coefficient. This is due in part to the starting up of a second growth.

An examination of the data for 1900 shows that No. 461 rates the lowest, due undoubtedly to the immaturity of the beet. This is proved by the increased percentage of sugar and higher purity coefficient noted for No. 462, harvested about one month later from the same field. No. 463 is a highly satisfactory beet in every respect.

BUTTE COUNTY.

Season of 1898.

No. 443. Sugar-beets from Chico; sent by General John Bidwell. Received in excellent condition.

Weight, 731 grams; specific gravity, 1.0810; solid contents, 19.50 per cent; cane sugar, 14.35 per cent; purity coefficient, 73.50.

The sugar content and purity coefficient are only fair.

SACRAMENTO COUNTY.

Season of 1898.

No. 442. Sugar-beets from Walnut Grove; sent by Locke & Lavenson, Sacramento. Received in good condition September 26th. Average weight of one beet, 1355 grams; specific gravity, 1.0640; solid contents, 15.60 per cent; cane sugar, 12.64 per cent; purity coefficient, 81.02; ash in juice, .52 per cent.

This beet is above the average weight of a first-class sugar-beet, and the sugar content approaches very closely the limit set by the sugar factories. The purity coefficient is good, considering the size of the beet.

Season of 1899.

No. 451. Sugar-beets from Walnut Grove; sent by Locke & Lavenson, Sacramento. Received in good condition September 8th.

Weight, 945 grams; specific gravity of juice, 1.0670; solid contents, 16.40 per cent; cane sugar, 14.20 per cent; purity coefficient, 86.53; ash in juice, .72 per cent.

This is a very desirable beet in all respects.

SONOMA COUNTY.

Season of 1898.

Nos. 435, 436, 438, 444. Sugar-beets from Reclamation Tract, near Petaluma; sent by Mr. R. Lichtenberg. Received in good condition, as follows: Nos. 435 and 436, August 31st; No. 438, September 15th; No. 444, October 12th.

Nos. 447, 448, 449. Sugar-beets from Petaluma; sent by Mr. M. D.

Hopkins. The beets arrived in good condition on October 27th, and were analyzed the same day.

No.	Variety.	Average Weight of One Beet.	Specific Gravity of Juice.	Solid Contents by Spindle.	Cane Sugar.	Purity Coefficient.	Ash in Juice.
	From R. Lichtenberg.	*Grams.*		*Per cent.*	*Per cent.*		*Per cent.*
435	Kleinwanzlebner	1 192	1.0761	18.40	14.04	76.30	1.25
436	Knauer Mangold	546	1.0885	21.20	18.70	88.40	.93
438	Kleinwanzlebner	595	1.0925	22.10	18.58	84.08	.96
444	Kleinwanzlebner	738	1.0964	22.90	18.40	80.70	1.06
	From M. D. Hopkins.						
447	Kleinwanzlebner	600	1.0750	18.10	16.57	91.54	.52
448	Kleinwanzlebner	512	1.0850	19.50	17.17	88.65	.51
449	Kleinwanzlebner	563	1.087	20.90	19.83	94.88	.57

Of the samples sent by Mr. Lichtenberg, the percentage of sugar in No. 435 is above the limit set by the factories, but the purity is somewhat low, due, no doubt, to the immaturity of the beet. That this is true is evidenced by the showing made by No. 438, harvested two weeks later, which is a marked improvement both with respect to the sugar rating and the purity coefficient. No. 436 is a high-grade beet in every respect. No. 444 shows a high sugar content, but the purity coefficient is lower than is desirable.

The purity coefficients of the beets sent by Mr. Hopkins are unusually high, notably so in case of No. 449. This, in connection with their richness in sugar and low ash content, makes them very valuable for sugar-making.

ALAMEDA COUNTY.

SEASON OF 1898.

Nos. 429, 430, 431, 432. Sugar-beets from Central Experiment Station, Berkeley. Harvested and received in good condition from the Economic Garden of the station on August 15th. These four samples are the result of four different plantings (fourteen days apart) of the same variety, under the same conditions. The first sowing, No. 429, was made April 2, 1898.

Nos. 439, 440, 441. Sugar-beets from Berkeley. Samples of beets were received in good condition from A. V. Stubenrauch on September 25, 1898, having been harvested the day previous.

No.	Variety.	Average Weight of One Beet.	Specific Gravity of Juice.	Solid Contents by Spindle.	Cane Sugar.	Purity Coefficient.	Ash in Juice.
		Grams.		*Per cent.*	*Per cent.*		*Per cent.*
429	Kleinwanzlebner	585	1.0753	18.20	16.55	90.93	-------
430	Kleinwanzlebner	475	1.0870	21.50	19.52	91.02	-------
431	Kleinwanzlebner	405	1.0739	17.90	15.90	88.79	-------
432	Kleinwanzlebner	410	1.0680	16.16	15.00	90.36	-------
439	Kleinwanzlebner	1,902	1.0730	17.70	14.85	83.90	.56
440	Kleinwanzlebner	503	1.0700	17.00	14.31	84.21	.69
441	Kleinwanzlebner	587	1.0745	18.00	15.53	86.28	.67

The results of the assays of the sugar-beets from the Experiment Station grounds for 1898 are highly satisfactory. The roots are first class in all respects; notably Nos. 429 and 430 with 16.55 per cent sugar content and 90.93 purity coefficient, and 19.52 per cent sugar content and 91.02 purity coefficient, respectively.

The sugar percentages and purity coefficients of Nos. 439, 440, and 441 prove that the beets are high-grade. No. 439, with 14.31 per cent sugar and 84.21 purity coefficient, is an excellent beet, considering the large size.

MARIN COUNTY.

SEASON OF 1899.

Nos. 455, 457. Sugar-beets from Tomales; sent by James W. Keys. Received in good condition on October 17th and November 2d, 1899, respectively. The corresponding dates for harvesting were October 15th and November 1st.

No. 456. Sugar-beets from Tomales; sent by William Basset. Received in good condition on October 24th, 1899; having been harvested the day previous. The date of planting was April 15th.

No.	Variety.	Average Weight of One Beet.	Specific Gravity of Juice.	Solid Contents by Spindle.	Cane Sugar.	Purity Coefficient.	Ash in Juice.
		Grams.		*Per cent.*	*Per cent.*		*Per cent.*
455	Kleinwanzlebner	364	1.0991	23.50	22.67	92.85	.60
456	Kleinwanzlebner	755	1.0918	21.90	19.94	91.04	.56
457	Kleinwanzlebner	398	1.0788	19.00	17.15	90.26	.56

No. 455 of the season of 1899 rates exceptionally high, both with respect to the sugar content (22.67) and the purity coefficient (92.85). This beet would command a large premium at the sugar factory.

The showing made by Nos. 456 and 457, while not being as good as that of the previous number, is an exceedingly desirable one. The three results are highly satisfactory and very encouraging for the locality.

SAN JOAQUIN COUNTY.

SEASON OF 1898.

No. 433. Sugar-beets from Boyce's ranch, near Woodbridge; sent by J. E. Culp. Received in good condition on August 16th.

No. 437. Sugar-beets from Lodi. Harvested September 7th and received at the laboratory in good condition September 10th.

No.	Variety.	Average Weight of One Beet	Specific Gravity of Juice.	Solid Contents by Spindle.	Cane Sugar	Purity Coefficient.	Ash in Juice.
		Grams.		*Per cent.*	*Per cent.*		*Per cent.*
433	Kleinwanzlebner	392	1.0744	18.00	14.98	83.21	.67
437	Russian seed	187	1.0609	14.90	11.55	77.52	.80

No. 433 is representative of a high-grade product for season of 1898.

In No. 437 both the sugar percentage and the purity coefficient are below the requirements of the sugar factories.

TULARE COUNTY.

SEASON OF 1899.

Nos. 459, 460. Sugar-beets from Visalia; sent by A. G. Wisben. Received in good condition on February 4 and March 17, 1900, respectively; having been harvested the day previous to the date of arrival in each case.

No.	Variety.	Average Weight of One Beet.	Specific Gravity of Juice.	Solid Contents by Spindle.	Cane Sugar.	Purity Coefficient.	Ash in Juice.
		Grams.		*Per cent.*	*Per cent.*		*Per cent.*
459	Unknown	405	1.0647	15.80	10.92	69.12	.94
460	Unknown	369	1.0570	14.00	10.76	76.90	1.00

Those of 1899 are low-grade beets, but it must be remembered that they are samples from a volunteer crop after the rains of October, 1899.

FRUITS, TANNING MATERIALS, HOPS, ETC.

By George E. Colby.

SMYRNA FIGS.

The following are the analyses of dried commercial Smyrna figs that were produced and packed at Fresno by George C. Roeding; crop of 1900.

"These figs were not sulfured, having received only a dip in weak brine (three ounces of common salt to one gallon of water)."

The specimens sent for examination were very large, averaging three-fourths of an ounce in weight; the color was a dull amber, with no crust of sugar on the skin; the skin appeared to be thicker than on ordinary Smyrna, and had a certain degree of toughness. This dried fruit had apparently not passed through the "sweat" period. It remains to be seen if closer drying will prevent the toughness of the skin.

Analysis of Commercial Smyrna Figs.

	Fresno Smyrna Figs.		Imported Smyrna Figs.
	The Substance as received Contains	Calculated upon a Basis of 21.06 per cent Water.	
	Per cent.	*Per cent.*	*Per cent.*
Water	33.43	21.06	21.06
Ash	1.44	1.72	1.80
Proteids	3.69	4.37	4.06
Crude fiber	6.76	8.02	10.58
Fat	.76	.91	
Sugar (Grape and Fruit)	54.00	63.92	62.50
Sugar (Cane)	none	none	------
Starch	none	none	------
Totals	100.00	100.00	100.00

These figs contain about 50 per cent more water than is found in the imported lot. In order to get a proper comparison, the analysis was recalculated to the same water content—21 per cent. On this basis the Fresno fruit makes a fine showing, having 1½ per cent more sugar and nearly one third per cent more of proteids, or flesh-forming ingredients. In both these respects the results agree with what we have observed in the case of other fruits, notably apricots and prunes, which are both sweeter and more nourishing than the European-grown. The facts above given for the *packed* dried figs are applicable also to the samples of *unpacked* dried fruit, as will be seen in the following statement showing the composition of some other dried figs (Smyrna varieties), crop of

1900. These samples were unpacked (i. e., loose), and were raised and dried at Fresno, by G. C. Roeding.

	Black Bulletin.	Bardajic.	Cassaba.
	Per cent.	*Per cent.*	*Per cent.*
Water	24.25	23.02	23.62
Protein	4.42	4.20	3.94
Sugar	62.50	63.70	64.10
Fat	.60	.80	.80
Fiber	7.32	6.96	6.00
Ash	.92	1.16	1.34
Totals	100.01	99.84	99.80
Seeds	5.2	3.4	2.8

COMPOSITION OF THE SEED OF DRIED SMYRNA FIGS; BLACK BULLETIN.

The results of the examination of the seed of figs are perhaps of some value to those who make a study of the nutrients of this fruit. One hundred parts of seeds contain:

Water	6.0
Protein	14.0
Carbohydrates*	13.5
Fat	34.4
Fiber	30.4
Ash	1.7
Total	100.0

COMPARATIVE EXAMINATION OF SHIPPING NAVEL ORANGES FROM THE NORTHERN, MIDDLE, AND SOUTHERN PARTS OF THE STATE.

The following is a preliminary report on a systematic study of the process and progress of the maturing of Navel oranges in the three respective citrus centers of the State, to which reference has already been made in previous reports. Requests were sent to quite a large number of growers for samples in ample quantity for the investigation, to be taken and sent to this Station from time to time during the season. The responses to these requests were not as numerous, from some localities, as could be desired. But on the whole some valuable results were obtained, and which confirm to a great extent the opinions held in this Station regarding California shipping Navels.

The data below comprise the analyses and study of:

First—Four samples of shipping Navels from the northern, seven from the middle, and eight from the southern citrus regions, gathered during the time extending from the third week in November to the same time in December, 1889.

Second—One sample from northern California taken February 17, 1900.

Third—Seven samples from southern California, gathered from January 1st to the middle of February, 1900.

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* Shows a few starch grains.

Descriptions of Samples from the Northern Citrus Region.—The fruit was gathered from about the middle of November to the middle of December.

No. 335. From Thermalito; sent by the Oroville Citrus Association. The fruit was of medium size; rind yellow in color, thin and easily separated from the flesh. The flesh consisted of imperfectly formed segments, tender and juicy; taste only slightly bitter.

No. 336. From Palermo; sent by Bates & Boalt. The fruit was of medium size; the rind was mottled green and yellow, and separated easily from the flesh; the segments of flesh were perfect in form, tender but watery, and with a taste not at all bitter.

No. 339. From Palermo; sent by A. Trost. The fruit was of medium size; the rind was mottled green and yellow, and quite hard to remove; the flesh rather tender and with hardly a trace of bitterness.

No. 344. The last of the shipping Navels from Thermalito; picked February 17, 1900. The fruit was of a yellow color, and the rind was easily removed from the flesh; the flesh was tender and very juicy and without any bitter taste.

No. 345. The last of the shipping Navels sent by A. Trost of Palermo. The fruit was undersized and the base tinged with a green color; the rind was very tenacious; the flesh was tough and not very juicy, and without bitterness to the taste.

Samples from the San Joaquin Valley Citrus Region.—The fruit was gathered from about the middle of November to the middle of December.

No. 331. Shipping Navels grown on lowland at Porterville; sent by J. T. Bearss. The fruit was large and with a yellow skin, which separated easily from the flesh. The flesh was tender, juicy, and not at all bitter.

No. 332. Shipping Navels growing on hill land at Porterville; sent by J. T. Bearss. The fruit was of average size, with deep yellow-colored skin; the flesh was dryish and with a somewhat bitter taste.

No. 333. Navels from coarse sandy land; sent by J. T. Bearss of Porterville. While grown on young trees, the fruit was the smallest sent from the valley. It had a yellow skin, dry flesh, and bitter taste.

No. 334. Shipping Navels of average quality grown by the Sunnyside Vineyard Company, Fresno. "These are the last of the crop of the year." The fruit was deep yellow in color; the segments of flesh were perfect, but with a slightly bitter taste.

No. 338. Shipping Navels from the place of F. G. Berry, Fresno. The fruit was very large, with a mottled green and yellow skin, which was thin and easily separated from the flesh. The flesh was tender, and very bitter to the taste.

No. 346. Shipping Navels grown on the black adobe soil of Porterville; sent by J. T. Bearss. The skin was thin, smooth, and yellow colored, and separated very easily from the flesh. The flesh was tender and juicy, and with a pleasant taste.

No. 347. Shipping Navels grown on the lowest land at Porterville; sent by J. T. Bearss. The skin was rough and green-colored at the base, and was easily separated from the flesh. The flesh was tender and not bitter.

Samples from the Southern California Citrus Region.—(1) Fruit gathered from about the middle of November to the middle of December, 1899:

No. 328. Shipping Navels from West Riverside; sent by D. L. Wilbur. The fruit was undersized and the skin green at the base, and so thick and tenacious that it would not peel off from the flesh, but had to be cut. The taste of the flesh was bitter.

No. 329. Shipping Navels from East Riverside; sent by D. L. Wilbur. The fruit in this case also was undersized, green at the base, and the skin so hard and thick that it had to be cut off. The taste was better than that of No. 328.

No. 330. Navels from the Southern California Experiment Station orchard near Pomona. The fruit was undersized, the color mottled green and yellow, and the skin hard and thick, and so tenacious that it had to be cut from the flesh. The taste of the flesh was quite bitter.

No. 337. Shipping Navels from Corona; grown by George Van Kirk. The fruit was small and the color mottled green and yellow. The skin was much easier to remove from the flesh than was that of the samples from Riverside and Pomona just mentioned. The taste of the juice was pleasant and not in the least bitter.

No. 340. Shipping Navels from Redlands (Grafton); grown and sent by Charles R. Paine. The fruit was undersized and the color yellow; the skin peeled off with difficulty; the flesh, perfect in segments, was juicy and with a pleasant taste.

No. 341. Shipping Navels from Orange; grown and sent by A. D. Bishop. The fruit was undersized, with a skin only slightly mottled in color, but hard to remove from the flesh. The segments of the flesh were hard and unripe, partly perfect in some specimens and distorted by the navel extending through the orange. The taste was sour, lemon-like, but not bitter.

No. 342. Shipping Navels from San Diego; sent by George P. Hall. They were undersized, and mottled green and yellow in color. The rind was hard and adhered to the flesh. The flesh was coarse, hard, sour, and bitter.

No. 343. Shipping Navels from Colton; sent by W. C. Fuller. They were undersized, with a yellow color. The skin was easily removed; the flesh was dryish, not delicate, though having a ripe taste, and with not the faintest bitterness.

(2) Fruit gathered from January 1st to middle of February, 1900:

No. 348. Shipping Navels from Redlands (Grafton); picked January 1st, and sent by Charles R. Paine. They were rather undersized and with a yellow color; the skin was easily removed; the flesh was tender and with a pleasant taste.

No. 349. Shipping Navels from San Diego; picked January 1st, and sent by George P. Hall. They were undersized and with a yellow color; the skin was not easily removed from the flesh; the flesh was tender and juicy, and without a bitter taste.

No. 350. Shipping Navels from Riverside; picked January 8th from the orchard of D. L. Wilbur. They were of medium size; the skin yellow and easily removed from the flesh; the flesh was tender, juicy, and had a sweet taste and pleasant acidity.

No. 351. Shipping Navels from Corona; picked January 8th, and sent by George Van Kirk. They were undersized and with a yellowish-red color, but impaired by scale marks. The skin was difficult to remove from the flesh; the flesh was tender, juicy, and highly flavored.

No. 352. Shipping Navels from Colton; picked January 6th, and sent by W. C. Fuller. They were undersized and with a yellow color; the skin was hard to remove; the flesh tender, juicy, and with a pleasant taste.

No. 353. Shipping Navels from Orange; picked January 15th, and grown and sent by A. D. Bishop. They were of medium size, with a yellow skin, which separated easily from the flesh. The flesh was tender and juicy.

No. 355. Navels from Highlands; picked February 2d, and sent by E. T. Yokum. They were of medium size, with a yellow skin, which separated easily from the flesh. The flesh was tender and delicate, with a sweet taste and pleasant acidity.

No. 387. Navels from Chino; picked December 14, 1900, by J. P. Dreher. The fruit was mostly green at the base, yellow to pale yellow on other parts. The skin was brittle, and adhered to the flesh, which had a sour taste. This sample is reported in this place only for comparison with No. 330, which was picked a year earlier, November 23, 1899. It does not, however, show any improvement in degree of ripeness over the earlier one.

TABLE I. ANALYSES OF SHIPPING NAVELS FROM THE CHIEF CITRUS REGIONS OF CALIFORNIA.

Serial Number	Place of Production.	Sender.	Date of Picking.	Color of Rind.	PHYSICAL ANALYSIS.				ANALYSIS OF JUICE.			Flavor 30 Points)
					Average Weight	Rind	Flesh.		Total Solid Contents by Spindle	Total Sugars	Acid (Citric)	
							Pulp, Pressed	Juice				
	Northern Citrus Region.				Grams.*	Per cent	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
335	Thermalito	Oroville Citrus Ass'n	Nov. 26, 1899	Yellow	262	24.7	25.4	49.9	11.20	8.05	1.12	19
336	Palermo	Bates & Boalt	Nov. 29, 1899	Mottled green and yellow	242	28.3	22.4	49.3	9.50	6.89	.91	17
339	Palermo	A. Trost	Nov. 27, 1899	Mottled green and yellow	262	29.0	21.4	49.6	9.30	6.60	.91	20
344	Thermalito	W. H. Murray	Feb. 17, 1900	Yellow	245	25.3	23.8	50.9	11.40	8.40	1.05	19
345	Palermo	A. Trost	Dec. 15, 1899	Only slight tinge of green	195	28.0	25.5	46.5	10.00	7.93	.84	18
	San Joaquin Valley Citrus Region.											
331	Porterville	J. T. Bearss	Nov. 23, 1899	Yellow	298	28.8	25.2	46.0	12.60	9.00	1.12	22
332	Porterville	J. T. Bearss	Nov. 23, 1899	Yellow	255	29.0	26.1	44.9	12.40	8.74	1.15	20
333	Porterville	J. T. Bearss	Nov. 23, 1899	Yellow	194	29.9	27.8	43.3	12.40	8.67	1.51	18
334	Fresno	W. H. MacLaymott	Nov. 24, 1899	Yellow	298	30.8	24.6	44.6	11.70	8.54	1.12	19
338	Fresno	F. G. Berry	Nov. 23, 1899	Mottled green and yellow	391	22.2	21.3	56.5	10.60	7.22	1.40	17
346	Porterville	J. T. Bearss	Dec. 20, 1899	Yellow	200	27.9	23.7	48.4	11.40	8.82	.86	20
347	Porterville	J. T. Bearss	Dec. 20, 1899	Slight green	194	25.5	21.9	52.6	13.20	10.52	1.40	18
	Southern Citrus Region.											
328	Riverside	D. L. Wilbur	Nov. 23, 1899	Base; green	193	27.7	20.7	51.6	11.20	8.24	1.12	18
329	Riverside	D. L. Wilbur	Nov. 23, 1899	Base; green	168	28.8	23.7	47.5	12.30	8.82	1.23	18
330	Pomona	Agr'l Exp't Station	Nov. 23, 1899	Mottled green and yellow	152	30.4	25.1	44.5	13.20	9.29	1.86	19
337	Corona	Geo. Van Kirk	Nov. 27, 1899	Mottled green and yellow	159	28.0	25.1	46.9	43.10	10.38	1.47	23
340	Redlands (Grafton)	C. R. Paine	Nov. 28, 1899	Yellow	208	32.0	22.0	46.0	12.00	8.82	1.26	19
341	Orange	A. D. Bishop	Dec. 1, 1899	Mottled green and yellow	213	31.7	31.3	37.0	10.60	8.05	1.54	17

TABLE I. ANALYSES OF SHIPPING NAVELS FROM THE CHIEF CITRUS REGIONS OF CALIFORNIA—*Continued.*

Serial Number	Place of Production.	Sender.	Date of Picking.	Color of Rind.	PHYSICAL ANALYSIS.				ANALYSIS OF JUICE.			Flavor (30 Points)
							Flesh.					
					Average Weight	Rind	Pulp Pressed	Juice	Total Solid Contents by Spindle	Total Sugars	Acid (Citric)	
	Southern Citrus Region—Continued.											
					*Grams.**	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
342	San Diego	Geo. P. Hall	Dec. 3, 1899	Mottled green and yellow	191	30.6	27.1	42.3	10.00	7.74	1.84	17
343	Colton	W. C. Fuller	Dec. 3, 1899	Yellow	191	26.9	28.3	43.8	12.00	8.82	1.19	20
348	Redlands (Grafton)	C. R. Paine	Jan. 1, 1900	Yellow	209	26.7	29.8	43.3	13.10	10.17	1.47	22
349	San Diego	Geo. P. Hall	Jan. 1, 1900	Yellow	170	27.1	27.1	45.8	12.80	10.00	1.55	20
350	Riverside	D. L. Wilbur	Jan. 8, 1900	Yellow	212	26.9	27.3	45.8	13.00	10.33	.98	23
351	Corona	Geo. Van Kirk	Jan. 6, 1900	Yellow red	187	30.2	29.1	40.7	12.60	10 00	.91	25
352	Colton	W. C. Fuller	Jan. 6, 1900	Yellow	163	27.8	25.5	43.7	14.10	11.40	1.07	25
353	Orange	A. D. Bishop	Jan. 5, 1900	Yellow	224	27.1	31.4	41.5	12.30	9.29	1.22	24
355	Highlands	E. T. Yokum	Feb. 15, 1900	Yellow	233	28.7	26.5	44.8	13.15	11.10	.81	24
387	Chino	J. P. Dreher	Dec. 14, 1900	Base; green	202	27.0	18.0	55.0	11.60	8.74	1.47	21
	Averages: Shipping fruit from—											
	Northern region (Nov. 23 to Dec. 23, 1899)				240	27.4	24.2	48.4	10.00	7.37	.94	18
	Valley region (Nov. 23 to Dec. 23, 1899)				261	27.7	24.4	47.9	11.90	8.78	1.22	19
	Southern region (Nov. 23 to Dec. 23, 1899)				184	29.5	25.4	45.1	11.80	8.77	1.43	19
	Standard for California Navels				288	28.4	30.0	41.6	13.30	10.46	.97	25

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* About 30 grams are equivalent to 1 ounce.

Value of the Results.—The commercial importance of the shipping Navels gathered during the time extending from the middle of November to the middle of December makes them prominent among the fruits studied. The early-gathered Navels are chiefly intended for the Eastern Christmas holiday trade; hence, the importance of ascertaining how they stand in degree of ripeness when shipped early enough to accomplish this purpose.

The results furnished by the analysis of the later-gathered Navels (wherever they were obtainable) fills a demand for information regarding the approach to full-ripeness, as well as emphasizing their admitted superiority over the earlier-gathered oranges.

And, although these results are not a sufficient basis for general conclusions, they give a sound foundation for very probable forecasts.

Sugar in Fruit a Measure of Ripeness.—The quantity of sugar in fruits is a safe gauge of their degree of ripeness, which is further determined in Navel oranges by the color of the skin, which in ripe Navels is deep yellow, or reddish-yellow. These commonly accepted facts are sometimes contradicted by shippers of oranges, who claim, it is said, that Navels with mottled-green and yellow-colored rinds are ripe because of some peculiar property possessed by the flesh of the Navels they sell. Undoubtedly this flesh has some remarkably firm "eating qualities"—delicacy and sprightliness—which, perhaps, may be the reason why the deficiency in sweetness is overlooked—the more so if the acidity happens to be just right.

Size (weight) and Waste (rind) of the Early Shipping Navels Received.—The most desirable weight for Navels for packing purposes varies but little from six to seven ounces; those from the southern regions on the average follow this very closely; some of the valley Navels are easily seen to be too large for this purpose, weighing, as they do, from nine to as much as twelve ounces.

The amount of *real waste* part of the fruit, the rind, is quite the same, and below the standard, for both the northern and valley region Navels. The southern-grown oranges show the most rind; possibly the more generous use of fertilizers in this region is a sufficient explanation for the increased rind-content over that of the standard.

Maturity of Shipping Navels—Sugar and Acid in Juice.—In this chief indication of maturity, viz., the sugar content of the juice of oranges, it appears that the November and December Navels of the northern region are about 1⅓ per cent *less* on the average in total sugar than either the valley or the southern fruits; the northern yielding 7.37, as against 8.80 of sugar in that of the other regions.

It is notable that the proportion of acid to sugar in the juice, while it varies somewhat, stands about 1 to 7, or nearly 8, in all the shipping Navels of November and December. This proportion is considerably out of line when compared with that of the standard, where this relation has been determined to be 1 of acid to 10.5 of *sugar*.

The northern Navels make slightly the best showing, having the proportion of 1 to nearly 8 (with the lowest average total sugar). This, with their fine eating qualities, has perhaps given shippers the impression that these, the most juicy fruits of all examined, are the ripest.

But our record given above, that "bitterness" is pronounced in all the early fruit, would contradict this impression.

TABLE II. SUGAR AND ACID IN JUICE OF SHIPPING NAVELS.

Citrus Regions.	Early Shipping Navels.						California Standard Navels.	
	Maximum.		Minimum.		Average.			
	Sugar.	Acid.	Sugar.	Acid.	Sugar.	Acid.	Sugar.	Acid.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Northern	8.40	1.05	6.60	.94	7.37	.94	10.46	.97
Valley	10.52	1.40	7.22	1.40	8.78	1.22	--------	-------
Southern	10.38	1.47	8.05	1.54	8.77	1.43	--------	--------

An inspection of the tables of analyses shows hardly any case where the highest sugars are in combination with a relatively low acid, as in the established standard where this nice adjustment is found, without, too, any impression of bitter taste. The January and February Navels following those of November and December from southern regions (none of these are ever procurable from the north) show that the sugar rises very quickly to that of the standard, and the proportion of acid and sugar in the juice in most cases becomes or closely approaches the normal.

On the average, then, these November and December shipping Navels have all attained about the same degree of maturity, judging from their sugar content. This degree of ripeness may be roughly expressed in figures as *four fifths* of that possessed by the fully matured standard Navels of California.

It seems improbable that the shipping fruit of November and December would ever ripen enough in transit, or afterward in the market, to bring up the sugar to that produced in the orchard in later-picked fruit, or to that of the standard. Our experience with keeping oranges over two months has been that the increase in sugar is very small—only $\frac{1}{3}$ of a point; e. g., from 10 to only 10.3 per cent total sugar.

One other comparison seems to be demanded, viz., that of the shipping Navels of November and December with the *best* samples of oranges that have been submitted to the Station for examination. For this purpose the averages obtained on the shipping Navels are placed alongside of the results of analyses of the fully-ripe fruits.

Passing the data relating to the size and the amounts of rind and juice, in all of which results the varieties are so marked that they need not be specially mentioned, the most striking point in the table (III) seems to be one relating to the sugar in the fully-ripe Navel from the north. As far as this record goes, the northern region has developed very early (December 5th) a total sugar in the juice of the Navel orange amounting to 10.52 per cent. This amount of sugar is only found in one other sample, the March 12th Navel from Duarte, southern California region. Probably as the northern orchards grow older, it will be more common for their earliest output to reach full maturity in early December. At any rate there seems to be a possibility of Navels attaining very early full maturity in the northern citrus regions.

TABLE III. RESULTS OF ANALYSES OF SHIPPING AND FULLY-RIPE NAVELS.

	NORTHERN REGION.		SAN JOAQUIN VALLEY REGION.		SOUTHERN REGION.	
	Average Shipping Navels.	Fully-ripe Navels (Highest Sugar Content).	Average Shipping Navels.	Fully-ripe Navels (Highest Sugar Content).	Average Shipping Navels.	Fully-ripe Navels (Highest Sugar Content).
Date of picking	Nov. 23–Dec. 15	Dec. 5th	Nov. 23–Dec. 20	March 3d	Nov. 15–Dec. 5	March 12th
Color of rind	Yellow to mottled green and yellow	Yellow	Some yellow—mostly mottled green & yellow	Yellow	Mostly green and yellow	Yellow, or Yellow-red
Physical Analysis:—						
Average weight, in grams	240	221	261	333	184	307
Rind, per cent	27.4	23.9	27.7	36.0	29.5	18.6
Pulp, pressed, per cent	24.2	39.4	24.4	25.5	25.4	41.0
Juice, per cent	48.4	36.7	47 9	38.5	45.1	40.4
Analysis of Juice:—						
Total solid contents, per cent	10.00	12.90	11.90	12.46	11.80	13.80
Total sugars, per cent	7.37	10.52	8.78	10.35	8.77	11.50
Acid (citric), per cent	.94	1.33	1.22	.87	1.43	1.68
Flavor (standard, 30 points)	21	27	19	----------	19	----------

ANALYSES OF HOP CONES AND HOP VINES.

Samples of hop vines and cones were received from the respective hop ranches of Ukiah, Sacramento, and Wheatland, for examination to determine the amount of mineral ingredients this crop withdraws from the soil, and with a view toward applying the proper fertilizers to prevent exhaustion of the soil. The samples were sent by Messrs. Horst Bros., of Wheatland.

Analyses of the Ashes of Hops (Cones) from Ukiah, Wheatland, and Sacramento, Cal.

	Ukiah Hops.		Wheatland Hops.		Sacramento Hops.	
	Per cent.		*Per cent.*		*Per cent.*	
Pure ash, in air dried hops	5.80		8.65		14.52	
Insoluble silica	6.27	19.77	36.73	42.49	34.29	51.50
Soluble silica	13.50		5.76		17.21	
Potash (K_2O)	25.08		10.98		11.79	
Soda (Na_2O)	.33		.54		1.51	
Lime (CaO)	16.39		12.49		-----	
Magnesia (MgO)	9.32		8.14		-----	
Br. oxid of manganese (Mn_3O_4)	.29		.33		-----	
Peroxid of iron and alumina	2.15		2.16		-----	
Phosphoric acid (P_2O_5)	15.83		13.16		7.40	
Sulfuric acid (SO_3)	9.74		8.59		-----	
Chlorin (Cl)	1.37		1.37		-----	
Total	100.27		100.25		-----	
Less O due to Cl	.26		.26		-----	
Total	100.01		99.99		-----	

The results of the analyses as given above will not help to answer the real question involved, unless the fine *sand or silica* be taken away. This material, as every one knows, is in part upon the cones in such shape that it is impossible to remove it before analysis. A better way of presenting the analysis, for the important ingredients at least, is to deduct the fine sand or silica, and then calculate the results upon a silica-free basis.

Ingredients of Hop Ashes, Calculated upon Silica-Free Ash.

Mineral Ingredients.	Ukiah Hops.	Wheatland Hops.	Sacramento Hops.
	Per cent.	*Per cent.*	*Per cent.*
Potash (K_2O)	31.29	19.15	24.24
Lime (CaO)	20.44	21.79	not det'r.
Phosphoric acid (P_2O_5)	19.71	22.89	15.29
Silica-free ash, in air-dried hops	4.63	4.97	7.04

Analyses of Soils of Hop Fields Near Wheatland.—These samples of soil were taken and analyzed by F. J. Snow, assistant in the agricultural laboratory, from the hop field of Mr. Horst, three miles east of Wheatland, Yuba County.

Nos. 2403, 2405. *Alluvial soils* from the first and third foot respectively, taken from the southeast corner of the "Flagg place," on the extreme west side of the tract. This is the richest land of the field, is north of and very close to the river levee, and produced a large crop of good quality. Water was found in the third foot.

No. 2408. *Alluvial subsoil* from the third foot of a slightly higher portion of the "Flagg place" above mentioned, but on which the hop vines were not thrifty, the hops being small, poorly developed, and dried up, and became red about picking-time; the soil is lumpy, uneven, and soggy, and shows white alkali spots here and there. The upper two feet is a rich black loam, the third foot a reddish clay, which becomes slightly more gravelly downward through the sixth foot. Water was found in the fourth foot; the land is drained by small ditches.

No. 2411. *Sandy alluvial subsoil* from center of the small hop field on the south side of the river and about one hundred yards from the river levee; the land was being cleared of a very thick growth of willow and brush. The first foot is very sandy, the second a reddish loam, the third a white sand, the fourth a layer of slickens, the fifth and sixth a reddish sand. The third foot alone has been analyzed.

	WEST SIDE OF THE TRACT.			SOUTH OF RIVER. Virgin Land. Third Foot. No. 2411.
	Good Growth.		Poorer Growth.	
	First Foot. No. 2403.	Third Foot. No. 2405.	Third Foot. No. 2408.	
Coarse materials > 0.55 mm.	------	4.00	1.00	1.00
Fine earth	all	96.00	99.00	99.00
	100.00	100.00	100.00	100.00
Chemical Analysis of Fine Earth.				
Insoluble matter	56.66	57.85	50.45	78.61
Soluble silica	16.15	15.03	17.37	8.63
Potash (K_2O)	.42	.42	.65	.23
Soda (Na_2O)	.28	.14	.13	.13
Lime (CaO)	.72	.97	.83	.25
Magnesia (MgO)	1.45	1.83	1.50	.29
Br. ox. of manganese (Mn_3O_4)	.14	.14	.11	.07
Peroxid of iron (Fe_2O_3)	8.15	15.42	12.95	6.24
Alumina (Al_2O_3)	8.87	3.27	9.79	2.57
Phosphoric acid (P_2O_5)	.20	.14	.21	.09
Sulfuric acid (SO_3)	.11	.05	.01	.05
Carbonic acid (CO_2)	-------	------	-------	-------
Water and organic matter	6.70	4 70	5.77	2.71
Total	99 85	99.96	99.77	99.87
Humus	1.50	-------	-------	-------
Humus ash	.36	------	-------	-------
Humus nitrogen, per cent in humus	16.00	-------	-------	-----
Humus nitrogen, per cent in soil	.24	-------	-------	------
Available phosph. acid (citrate method)	.027	.023	.023	.025
Hygroscopic moisture (absorbed at 15°C)	7.78	7.31	9.35	3.54

Professor Hilgard says in regard to the analyses of the hop cones and the Wheatland hop ranch soil: "The analyses of the hops from Wheatland as well as from Sacramento make it clear that there is a very notable deficiency of potash, and not, apparently, a deficiency of phosphoric acid. These analyses therefore confirm the conclusion drawn from the analysis of the soil, viz., that potash fertilization is necessary—a requirement which we had previously established for the uplands in the Wheatland region, from which the soil upon which the hops were grown has largely been washed. Undoubtedly, a large portion of the land would be greatly benefited by the use of hop-vines to add humus and to relieve the stiffness, besides adding fertilizing matter. But there are two places, at least, in which mere fertilization seems unlikely to accomplish much improvement: one is the place where slickens underlies; the other where almost pure sand lies on top of a heavy clay subsoil at a depth of two feet. The slickens makes a fatally defective subsoil for a deep-rooting plant like hops. It interferes with the ascent of moisture as well as with the root-penetration, and furnishes no available plant-food."

Hop Ranch Soils and Fertilization.—Another, if not the chief, value of the above analyses is that they indicate to the hop-producer the great necessity of the employment of *complete fertilizers*; and this, too, at a very early time, to replace the heavy draft upon his soil by the hop crop. From these analyses it is possible to calculate the number of pounds of important soil ingredients withdrawn by a given crop of hop cones and hop vines. For convenience, such facts may be stated in the following way:

SOIL INGREDIENTS EXTRACTED BY HOP CONES AND HOP VINES.

Crop of 1,000 Pounds.	Total Ash.	Potash.	Lime.	Phosphoric Acid.	Nitrogen.
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*
Entire plant	72.9	17.90	19.7	5.80	25.0
Ukiah hops	46.3	14.49	9.44	9.10	17.2
Wheatland hops	49.7	9.48	10.83	11.38	17.5
Sacramento hops	70.4	16.99	----	10.77	----
Hop vines or canes, dry; per ton	81.4	27.5	----	6.0	12.4

This presentation of results based upon silica-free ash shows that the hop cone withdraws an enormous quantity of important soil ingredients (plant-food), which go with the sale of the crop and can not be returned to the soil except by fertilization. The vine, too, exhausts greatly these materials, but it and its mineral content can be returned to the soil upon which the plants grew.

Compared with the grain of wheat, which takes away about the same quantities of phosphoric acid and nitrogen, hop cones and vines each carry away about three times more *potash*. None of the important orchard fruits or nuts begin to make as heavy a demand on potash and nitrogen as hop cones. Most of them take away about one fifth as much potash, the almond, olive, and walnut alone approaching the one half mark for both ingredients. No fruit or nut thus far examined here has been found to remove over *one fifth* as much phosphoric acid as hop cones. It thus appears that when hop soils begin to fail it will be necessary to fertilize them with such materials that they will receive a bountiful supply of potash, phosphoric acid, and nitrogen.

TANNING MATERIALS.

During the past three seasons analyses have been made of the following:

Canaigre, or Tanner's Dock: Fresh roots, "chips," and experimental samples produced by planting different sections of the root.

Wattles: Black, silver, and golden wattles from different localities.

Miscellaneous Materials: Oak-barks, commercial tannins, and Chinese gall-nuts produced in leaves of *Rhus semialata*, a variety of sumac, from punctures of insects.

The following table contains twenty-five analyses of canaigre root and chips, and these comprise all of the results obtained at this Station since July, 1897. The Station report for 1895–97 (pp. 186–190) presents the results of analyses to 1897; the report for 1894–95 gives directions for planting, harvesting, and marketing canaigre.

In the former report it was remarked that the highest percentages of tannin in the air-dried fresh roots received from several States and examined in this Station were as follows: California, 41.27; Arizona, 34.98; and Florida, 28.73. The best results by counties were as follows: Los Angeles, 41.27; Alameda, 37.35; Santa Barbara, 35.59; Kern, 35.53; San Bernardino, 34.20; Riverside, 31.55; Contra Costa, 31.35.

The analyses made since 1897 reduce the general average for the State to 30.6 per cent of tannin. The average of thirteen samples of commercial canaigre chips is 34.6 per cent of tannin.

ANALYSES OF THE CANAIGRE ROOT.

Number	Material.	Locality.	Sender or Grower.	Tannin.	
				Fresh ..	Air-Dried.
	Fresh Roots.			Per ct.	Per ct.
105	Canaigre	Santa Barbara Co.	I. M. Blockman	7.82	28.75
106	Canaigre, one root one year and over	San Bernardino Co.	Anglo-American Canaigre Co.	9.45	28.75
107	Canaigre, two young roots	San Bernardino Co.	Anglo-American Canaigre Co.	7.93	28.75
108	Canaigre, old root	San Bernardino Co.	Anglo-American Canaigre Co.	9.67	33.01
109	Canaigre	Los Angeles Co.	------	11.59	31.95
122	Canaigre	Turlock, Stanislaus Co.	R. J. Kerr	9.92	34.48
96	Canaigre	Rialto, S. Ber'dino Co.	Rialto Canaigre Plantation	7.42	24.03
	Sliced Dried Roots, "Chips," Commercial Samples.				
83	Dried canaigre	Chihuahua, Mexico	R. J. Kerr	------	40.75
84	Canaigre "chips"; sun dried	Kern County	D. E. Josephi	----	37.10
85	Canaigre "chips"; dried in shade	Kern County	D. E. Josephi		37.62
86	Canaigre, fresh roots	Visalia, Tulare Co.	G. A. Botsford	8.57	27.67
87	Canaigre "chips"	Rialto, S. Ber'dino Co.	Anglo-American Canaigre Co.	-----	20.90
88	Canaigre "chips"	Phœnix, Arizona	Anglo-American Canaigre Co.	----	34.48
92	Canaigre "chips"	Rialto, S. Ber'dino Co.	Anglo-American Canaigre Co.	-----	21.99
93	Canaigre "chips" (A)	Phœnix, Arizona	F. A. Gulley	--	33.96
94	Canaigre "chips" (B)	Phœnix, Arizona	F. A. Gulley	------	31.35
95	Canaigre "chips"	Weed Patch, Kern Co.	D. E. Josephi	----	30.35
	Average of 13 samples "chips," California-grown roots	----------	----------	------	34.60

Analyses of the Canaigre Root—*Continued.*

Number	Material.	Locality.	Sender or Grower.	Tannin. Fresh	Tannin. Air-Dried.
	Experimental Samples.				
97	Canaigre roots, "new growth," from cuts in fourths lengthwise	Berkeley, Alameda Co.	Experi'ental Garden	7.95	31.95
98	Canaigre roots, old portion	Berkeley, Alameda Co.	Experi'ental Garden	7.13	27.25
99	Canaigre, top section of root, "new growth"	Berkeley, Alameda Co.	Experi'ental Garden	7.96	30.88
100	Canaigre, top section of root, old portion	Berkeley, Alameda Co.	Experi'ental Garden	9.16	31.95
101	Canaigre, whole root, "new growth"	Berkeley, Alameda Co.	Experi'ental Garden	9.88	36.21
102	Canaigre, whole root, old portion	Berkeley, Alameda Co.	Experi'ental Garden	8.51	33.54
103	Canaigre roots, lower section, "stump," no new growth	Berkeley, Alameda Co.	Experi'ental Garden	6.91	29.28
104	Canaigre roots, middle section, no new growth	Berkeley, Alameda Co.	Experi'ental Garden	7.02	31.95
	Average 45 analyses California-grown canaigre	----------- ---- ------	------ -------------	-----	30.6

Productiveness of Different Sections of Canaigre Root.—In order to ascertain whether or not there was any difference in the productiveness of the several sections, several roots of good size were selected and cut, some into three cross-sections, and another into four longitudinal sections, and were planted separately in the experimental plot of the Central Station at Berkeley.

It was found that of the cross-sections, only the uppermost, viz., that containing the root-crown with its bud-germs, passed into active vegetation; the root growing downward from the cut surface so as to make up almost the normal shape, the new growth differing from the old in being of lighter color and much more smooth.

The four longitudinal sections, each having buds at the apex, also grew and tended to round out their angular shape. As will be seen from the table below, the increase in weight thus obtained was considerably greater than when the entire root was planted; the new growth in the latter case being mainly by the formation of small side roots.

The lower portion of the preceding table shows the numerical results of these experiments, which are further elucidated in the table below:

Production of Tannin in Samples of Canaigre Roots, Produced by Planting Different Sections of the Root.

	Increase in Growth.	Tannin in Air-dried Substance.	Coefficient of Tannin Production.
	Per cent.	*Per cent.*	
Whole Root—			
New growth	240	36.21	8,690.40
Old root	----	33.54	--- ----
Top Section of Root—			
New growth	949	30.88	29,305.12
Old root	----	31.95	--------
Middle Section of Root—			
Failed to sprout	0.0	31.95	--------
Lower Section of Root—			
Failed to sprout	0.0	29.28	--------
Root Cut in Four Longitudinal Sections—			
New growth	353	31.95	11,278.35
Old root	----	27.25	-------

The results are of special interest, in that they show a very great difference in the vitality of different parts of the root, the yield of new growth from the top section being nearly four times greater than that from the whole root. Doubtless owing to the absence of bud-germs, the middle and lower sections failed to sprout, but were otherwise in good condition.

The figures of the third column show how many times greater is the total tannin yield of the new growth than that found in the piece of root planted, and again emphasizes the great increase obtained by planting the upper section of the root; for instance, when the whole root is used, the tannin in its new growth is 8,690 times that found in the seed root; but when the top section alone is used the tannin of the new growth is 29,305 times that of the original section. It is clear, then, that quite a saving of tannin might be made if the upper section of the root be used for planting and the remainder be subjected to the extracting process.

Analyses of Wattle Barks.—The tannin percentage has been determined in the bark of the various parts of three kinds of wattle, grown in the experimental garden at the Central Station at Berkeley and in the Forestry Station at Santa Monica. The results are given in the following table:

No.	Substance.	Locality.	In Air-dried Substance.		Tannin in Water-Free Substance.
			Water.	Tannin.	
	BLACK WATTLE. (*Acacia decurrens.*)		*Per cent.*	*Per cent.*	*Per cent.*
119	Bark, main trees (1898)	Santa Monica	6.53	42.48	45.83
113	Bark, branches (1898)	Santa Monica	8.26	36.57	39.98
116	Bark, large roots (1898)	Santa Monica	5.28	31.35	33.10
	Bark, trees (1883)	Berkeley Exp. Gardens	14.85	41.40	48.60
	Bark, trees (1899)	Berkeley Exp. Gardens	8.00	50.05	54.40
	SILVER WATTLE. (*Acacia mollisima.*)				
118	Bark, main trees (1898)	Santa Monica	7.60	45.98	49.76
115	Bark, branches (1898)	Santa Monica	8.02	42.98	46.66
117	Bark, large roots (1898)	Santa Monica	7.89	32.37	35.18
123	Bark, main trees (1898)	Berkeley Exp. Gardens	7.58	35.53	38.54
124	Bark, branches (1898)	Berkeley Exp. Gardens	7.90	31.87	34.60
125	Bark, large roots (1898)	Berkeley Exp. Gardens	8.87	34.48	37.83
	GOLDEN WATTLE. (*Acacia pycnantha.*)				
120	Bark, main trees (1898)	Santa Monica	9.32	41.80	46.09
114	Bark, branches (1898)	Santa Monica	8.67	38.66	42.34
121	Bark, large roots (1898)	Santa Monica	7.10	47.02	50.58
	Bark, trees (1883)	Berkeley Exp. Gardens	7.43	41.60	46.80

The analyses of the wattles from Santa Monica Forestry Station were published on page 228 of the California Experiment Station Report for 1897–98, in conjunction with a description of some practical tests with these barks in a Los Angeles tannery.

The best return for tannin in air-dried bark (the condition in which it is used in practice) is shown to be 50.05 per cent in that of the main tree of a black wattle grown in Berkeley. Nearest this (about one tenth less) is that obtained in the bark of the silver wattle from Santa Monica. The other results leave little choice among the wattles, or parts of them, for tanning purposes, except the bark from the large roots of the golden wattle from Berkeley, which is found to be very rich in tannin. It contains 47.02 per cent of tannin, while the bark of the roots of the other wattles reach at best only 34.48 per cent.

The greatest tannin-producer among the Australian-grown wattles (Maiden, Wattles and Wattle Barks, Sydney, 1891) was found to be the golden wattle. This bark contained, in the water-free substance, 46.47 per cent; while the California bark of main trees of this variety showed almost as much, viz., 46.09, and the root bark of it yielded 50.28 per cent of tannin. Comparing the *best* tannin percentages of the black and silver wattles of Australia with those from California bark of main trees, it appears that the latter are much superior, for the results stand thus:

		Highest Percentage.
Black Wattle—	Australia	32.33
	California	54.40
Silver Wattle—	Australia	36.30
	California	49.76

Examination of Oak Tanbarks.—Samples sent by D. E. Josephi of San Francisco. Nos. 1 and 2, "samples from tanbark, stacked in stick, without shelter, during the rainy season in California." No. 3 had been kept under shelter:

	No. 1.	No. 2.	No. 3.
Tannin	10.20%	11.24%	16.30%

No. 3 is easily up to the standard in tannin, comparing very favorably with recently examined fresh oak bark (containing 16.50 per cent) from the tannery.

The analyses as well as the appearance of these oak tanbarks show, everything else being equal, that Nos. 1 and 2 have suffered most from winter exposure, although they still both contain fair working amounts of tanning material.

Chinese Gall-nuts.—These are produced on *Rhus semialata*, a variety of sumac, by punctures of an insect, *Aphis chinensis*, on leafstalks and branchlets for the purpose of depositing eggs; this causes the formation of so-called "physiological tannin." The sample examined was from a shipment of these *galls* to a Japanese firm in San Francisco. It was imported for the purpose of obtaining a tannin for use in the California wine industry. Mr. L. Y. Chiashi, of Tokio, Japan, while in San Francisco in June, 1898, brought the sample to this Station for examination and trial upon wines. The galls are "light and hollow, very much distorted by numerous protuberances, and are completely covered by a thick velvety green down." The inside wall is of a faint amethyst color, and the hollow space is quite full of skeletons, dried wings, etc., of the insects which caused the gall. These remnants cling to the walls, filling the protuberances, and make the process of cleaning the galls difficult and expensive. After cleaning and grinding to a fine powder, the content of tannin was found to be 75.24 per cent.

Trials of this material, *freshly cleaned* and reduced to fine powder, upon seven or eight red wines, at the usual rate of adding pure tannin to them, did not impair the taste of the wines. No bitterness was to be noted, even at the expiration of a few weeks. The employment of any such substitute for pure tannin for treating wines must always be at the risk of the user, because they are generally found to be moldy; at any rate, a small-scale test on wine should be made with these articles in advance of a commercial operation.

Commercial Tannins.—Samples furnished by Mr. M. V. Courtois, of San Francisco. The result of the examination was as follows:

No. 1.	Fine yellow powder (oak tannin)	93.45 per cent of tannin.
No. 2.	Grayish brown coarse material	67.20 per cent of tannin.

The No. 2 sample seems to be Chinese nut-gall that has been subjected to fermentation or mold; but the pulverized condition of the substance renders it impossible to determine this.

COMPOSITION AND VALUE OF WASTE MATERIALS OF THE FARM, ORCHARD, AND VINEYARD.

Samples of waste material of farms, etc., have been received from various sources for examination, and the results are given below for general information. They include grape pomaces, citrus fruit culls, refuse prunes, lime refuse, etc.

Composition of Grape Pomace.—Samples of pomace, both sweet and fermented, were received from the Morgan Hill Vineyard, Santa Clara County, for examination. The following tables show the results of the analysis, both with regard to the proximate ingredients and the composition of the ash:

GRAPE AND WINE POMACE.

	FIRST CROP.	SECOND CROP.	
	Sweet Pomace.	Fermented Pomace.	
	Pressed. (Unf'rmented.)	Not Pressed.	Pressed.
	Per cent.	*Per cent.*	*Per cent.*
WATER	50.00	70.59	54.92
ORGANIC MATTER:—			
Sugar	2.00	none	none
Alcohol	none	5.92	1.58
Bi-tartrate of potassium (cream of tartar)	4.00	5.60	7.50
*Tartaric acid (other forms)	.67	1.05	3.60
Cellulose, Tannin, etc.	35.96	12.84	25.11
Albuminoids	5.97	3.00	5.50
ASH, pure	1.40	1.00	1.79
Totals	100.00	100.00	100.00

* Obtained from Calcium Tartrate by practical working test; *i. e.*, by taking water-exhausted pomace (to remove cream of tartar) and treating with weak hydrochloric acid, removing calcium by throwing it down as sulfate with sulfuric acid and subsequent evaporation of the liquor, washing, etc., of the crude tartaric acid.

PERCENTAGE COMPOSITION OF ASH IN WINE POMACE FROM MORGAN HILL VINEYARD.

Pomace.	Pure Ash	Potash	Soda	Lime	Magnesia	Peroxid of Iron	Br. Ox. of Manganese	Phosphoric Acid	Sulfuric Acid	Silica	Chlorin	Total	Oxygen due to Chlorin	Total
Sweet pomace	1.40	45.28	1.36	23.84	5.54	1.56	.47	10.25	5.92	4.50	1.51	100.23	.33	99.90
Unpressed fermented pomace	1.00	37.06	.89	16.78	4.09	5.19	.56	19.96	7.78	4.71	3.85	100.87	.84	100.03
Pressed fermented pomace	1.79	46.28	1.45	15.95	2.25	8 20	.47	14.23	5.42	4.84	1.25	100.34	.27	100.07
European pomace (Boussingault)	-------	52.64	.58	15.26	3.13	4.58	--------	15.26	7 70	------	.58	------	-------	-------
European pomace (Albert)	-------	37.00	1.99	26.93	5.48	.59	-------	21.05	3.14	.78	1.20	------	------	-------

These analyses were made with the assistance of L. M. Tolman, graduate student, now of U. S. Department of Agriculture.

MANURIAL VALUE OF CRUDE GRAPE POMACE.

	Water	Potash	Phosphoric Acid	Nitrogen	FERTILIZING INGREDIENTS.			
					Pounds per Ton.			Valuation Per Ton
					Potash	Phosphoric Acid	Nitrogen	
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*lbs.*	*lbs.*	*lbs*	
Sweet pomace	50.00	.63	.140	.955	12.6	2.80	19.1	$2 60
Fermented pomace (unpressed)	70.59	.37	.199	.480	7.4	3.98	9.6	1 41
Fermented pomace (pressed)	54.92	.83	.250	.880	16.6	5.0	17.6	2 66
Mixed barnyard manure	75.00	.57	.300	.570	11.4	6.0	11.4	1 81

Manurial Value of Various Waste Materials of the Farm.

	Number of Analyses, Locality, Etc.	Water.	Common Salt	Fertilizing Ingredients.			
				Pounds per Ton.			Approximate Valuation per Ton.
				Potash.	Ph'sphoric Acid.	Nitrogen.	
Waste Materials—		*Per cent.*	*Per cent.*	*lbs.*	*lbs.*	*lbs.*	
Orange culls	Average, 9 analyses	85.0		4.2	2.50	3.66	$0 63
Lemon culls	Average, 2 analyses	84.0		5.1	1.15	3.00	55
Lemon pulp	Cal. Citrus Products Company	86.0		5.8	2.80	.60	49
Prunes, refuse	Average, 11 analyses	72.8		6.2	1.36	3.64	92
Olives, refuse	Average	55.0		5.12	2.86	19.49	2 50
Olive pomace	Napa	17.3		6.40	3.58	24.36	3 12
Peach pits, whole	As purchased	13.3		9.00	2.73	3.07	1 20
Apricot shells, air dry	Average, California			2.04	4.60	1.04	70
Hulls of nuts, Walnut	Average, California			27.70	1.94	3.40	1 76
Hulls of nuts, Almond	Average, California			23.65	2.35	6.00	1 83
Hulls of nuts, Chestnut	Average, California			4.00	3.40	7.20	1 00
Dry hop vines	Wheatland			27.5	6.00	12.40	2 75
Mixed barnyard manure	Average (Farmer's Bulletin, No. 21)	75.0		11.4	6.00	11.40	1 95
Grape pomace (old)	Cupertino	21.0		21.4	17.90	33.60	5 19
Grape pomace (fresh)	Morgan Hill (vineyard)	55.0		16.6	5.00	17.60	2 66
Wood of grape	Bulletin 61, Cal. State Board of Hort.			15.7	8.74	14.20	2 55
Hardwood ashes (unleached)	Bulletin 74, Agr'l Expt. Station, Maine			169.2	60.00		9 66
Softwood ashes (unleached)	Bulletin 74, Agr'l Expt. Station, Maine			93.0	36.00		5 37
Swamp deposit	Redondo	41.6	13.10	6.6	9.40	9.60	1 44
Marsh deposit	Redondo	53.7	3.30	14.0	15.60	10.00	2 30
Sea weed	Monterey	80.0		10.0	2.00	10.00	1 56
Kelp, calcined	San Diego		56.84	693.8	38.40		32 75
Lime refuse	California beet-sugar factories	27.7		1.0	41.60	5.60	2 27
Commercial Fertilizers, and Gypsum—							
Bone meal (superphosphate)	Ordinary materials as sold in this market				409.60		18 62
Tankage, bones					353.60	86.8	23 22
Thomas slag (odorless slag phos.)					464.00		18 28
Bat guano				55.6	182.40	160.0	29 70
Fish scrap				15.0	92.80	168.0	22 20
Gypsum (land plaster)				80 per	cent pure		6 00

Concerning the use and value of the above materials it is to be borne in mind:

First—That citrus-fruit culls should be composted with fresh, unslaked lime, which not only corrects their harmful acidity, but also takes up the water of the fruit. Where obtainable, lime refuse of beet-sugar factories may be substituted for unslaked lime with equal benefit to the product. Grape pomace also must be treated with lime to correct acidity before its application to the land. Lime from gas-works should not be used.

Second—That olive refuse and pomace and other substances bearing much fat or oil are slow-acting fertilizers; the fat must, therefore, be rotted before the manurial ingredients become available. Materials consisting largely of hard seeds, or pits of fruits, should be either ground up in a mill or crushed before their application; if germinable, may be sprouted.

Third—That materials containing large quantities of common salt can not be safely used for all crops; notably for tobacco. However, calcined kelp may take the place of "kainit."

Fourth—Barnyard manure serves as a practical basis of comparison for most of these materials. The question of cost of hauling them to the land, and their distribution upon it, governs their practical use, as in the case of barnyard manure, where long hauls negative its employment. Advantageous facilities, of course, in certain cases change this general conclusion.

OLIVES.

OLIVE VARIETIES AND THEIR ADAPTATION.*

By George E. Colby.

In the following pages we give a summary of the physical and chemical analyses of some of the more important and fully tested varieties of olives as grown in the several regions of the State, together with notes on some of the rarer (here) or not yet fully tested ones. By different regions of the State is meant partly geographic and partly climatic regions; thus, Sacramento Valley embraces the region from Chico, the northern (apparently) limit of the olive, to Sacramento; the "Bay region," all that part of central California over which the Bay climate prevails, including the Santa Clara Valley; the "San Joaquin Valley," that part of California drained by the San Joaquin River; the Sierra Foothill region, the low hilly belt bordering the Sierra Mountains east of the Great Valley, such localities as Auburn, Jackson, and Amador County generally; the southern Coast Range region includes Monterey, Santa Barbara, Ventura, and other counties; and for the present purpose southern California is made to include all localities from San Fernando to San Diego.

The descriptions given of the olives are taken from the reports of this Station for 1892–3 and 1894–5; the copies of which were destroyed in the fire of 1897.

During the last eight years, over seven hundred and forty samples of olives, representing fifty-seven varieties, have been examined here; six hundred and fifty analyses are comprised in the table of averages at the end of this bulletin; sixty to seventy of the remaining samples were received unnamed, and their analyses have served the purpose of assisting the interested grower in identifying his fruit; twenty-five specimens were accidentally lost, by fire, before analysis. The detailed results and discussion of this work, up to that relating to the crop of 1897, have been published in the California Experiment Station reports for the years 1892–3–4–5 and 6; this report contains the complete record of analyses to date.

In passing, attention is called to the fact that in this bulletin we deal mostly with facts relating to the size of the fruit, the amount of pit and amount of oil in the fruit, and not with the yield of fruit. This happens because there are at present no sufficiently extensive or accurate data upon the question of yields by the different varieties.

It will be noted in the table of averages, that the amount of oil contained in the pit is comparatively small, even as extracted by chemical processes. If all this pit oil were available and unobjectionable, the actual quantity would not pay for the trouble of extraction; and that such very small quantities disseminated throughout the hard material of the pits renders their expression by mechanical means a problem of no practical interest. Apart from the uselessness of attempting to extract the pit oil, the kernel imparts a disagreeable taste to the oil of the flesh with which it comes in contact, and impairs its keeping qualities.

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*Revision of Bulletin No. 123.

Discrepancies noted by the reader, between this and the earlier publications of this Station relating to the olive, may be explained by the fact that there now exists a broader basis for this later work.

The physical analyses for part of 1896 and all of 1897 were made with the assistance of R. K. Bishop, student in the agricultural laboratory.

THE MISSION OLIVE.

This name designates the variety found growing at the old missions in California. It has long been known that the so-called Mission olive embraced several varieties, or sub-varieties, at least.

Common, or Broad-Leaved, Mission Olive.—This is the commonest form of the Mission olive in California. The fruit is $\frac{13}{16}$ of an inch long by $\frac{10}{16}$ of an inch thick; ovate, oblique—sometimes very much so; the pit straight or slightly curved, $\frac{10}{16}$ of an inch long and $\frac{5}{16}$ of an inch thick. The fruit is very variable in size, single or in clusters of two or more; it ripens late in the coast region, sometimes not until February, but generally in December; while in warmer localities it ripens in November.

Other Mission Varieties.—On the University grounds there are now being studied three apparently distinct varieties of the Mission: (*a*) Broad-leaved, or Common Mission, already described; (*b*) Narrow-leaved Mission, a variety from L. A. Gould of Auburn, described as having a somewhat larger fruit than the broad-leaved variety, and a more straggling habit; (*c*) Early Mission, from A. A. Wheeler. It is of the Mission type, but ripens much earlier.

Whatever may be the differences, these are of the same type. There have been received at this Station during the last eight years one hundred and twelve samples of the Mission olive from sixty-five different and widely separated localities. The outlying culture stations of the University have supplied seven samples. A study of the results of the physical and chemical analyses of the Mission may be summarized as follows:

Size of Fruit.—It appears that the Mission as grown in southern California (San Fernando to San Diego) is but little larger than that from northern California (Chico to Sacramento), and neither of these regions produces fruit much larger than that coming from the southern Coast Range localities. For these three regions, it takes on the average, respectively, 100.8, 101.6, and 106.7 to make a pound avoirdupois. In the San Joaquin Valley and the Sierra Foothills the Mission olive is found to be smaller than the fruit from northern and southern California: In the Valley, 117.9; in the Foothills, 113.0 olives are required to weigh a pound. In the Bay region, this olive is found to be on the average very much smaller than from other parts of the State; requiring for a pound as many as 145.2 olives; due probably to the prevalence of heavy (adobe) soils. The average for the whole State is 111.6 per pound.

Percentage of Pit.—The southern California Mission olive, the largest of all, is found to contain the least waste material or pit content, the average being 15.8 per cent. The next in order are those from the San

Joaquin Valley and the southern Coast Range, with respectively 16.4 and 16.8 per cent of pit, while the northern California Mission olive has an average of 17 per cent of pit. The Foothill Mission olive, with 19.2 per cent, is slightly superior to the Bay fruit with 20.8 per cent of pit. These figures do not show great variation from the average pit-percentage of all the Missions, which is 17.2 per cent.

Oil in the Flesh.—The oil content of the flesh of the Mission olive from the Bay and Foothill regions is greater by three per cent and over, than that yielded by the northern- and southern-grown fruit, for the Bay Missions contain on the average 24.27 per cent, the Foothill olives 25.67 per cent, and the northern and southern Missions but 21.3 per cent of oil in the flesh. The southern Coast Range and the San Joaquin Valley Missions both have nearly 23.0 per cent of oil in the flesh, or about 1.50 per cent above the average for all.

Oil in the Pit (calculated upon whole fruit).—The Mission olive contains, along with the Manzanillo and the Columbella, less (.60 per cent) oil in the pit than any other olive variety that has been fully tested. This, together with the fact that little of the pit-oil can be extracted at best, is one reason why the taste of the oil of the Mission variety is not tainted with that of pit-oil. Another reason is that only a small part of the pits of the Mission contain any kernel at all.

Among the largely-grown varieties (Rubra, Manzanillo, Redding Picholine, Nevadillo Blanco, Mission, Uvaria, Pendulina, Oblonga, and Columbella) which constitute the chief part of the olive orchards of California, the Mission is shown in the table of averages to stand second in size, and to be only slightly inferior to the Manzanillo, which has the largest-sized fruit. Again, among these varieties it holds an intermediate position in size of pit; and in the oil content of the flesh, it is superior to most of them and nearly equal to the highest oil-producer, the Nevadillo Blanco.

These results emphasize the commonly accepted opinion that this variety is well suited both for pickling and for oil-making, and that it is, in all the different regions of the State, a good "all around" variety, safe to plant, especially upon new and untried lands. It produces an oil of good quality, which keeps well, and is also well adapted to pickling; a combination of qualities that further recommend it to the grower.

ANALYSES OF MISSION OLIVES.

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit.	Flesh.	Per Cent of Oil.		
							In Whole Fruit	In Flesh	In Pit, ref'd to Whole Fruit
688	Oroville	W. A. Beard	Nov. 24,'97	67.9	13.0	87 0	13.99	16.08	------
692	Oroville	J. G. Curtis	Nov. 24,'97	86.0	14.0	86.0	19.31	22.35	------
625	Sacramento	W. D. Lawton	Nov. 9,'97	126.8	18.0	82.0	18.13	22.11	------
645	Sacramento	Sac'to Olive Co.	Nov. 11,'97	129.7	17.0	83.0	11.23	13.52	------
683	Amador	University	Nov. 24,'97	90.6	18.0	82.0	20.05	24.45	------
650	Bird's Land'g.	Mrs. J. B. Hoyt	Nov. 13,'97	77.0	23.0	77.0	14.00	18.18	------
671	Clayton	Robt. Hastie	Nov. 18,'97	95.1	15.0	85.0	17.75	20.88	------
659	Oakdale	Haslacher & Kahn	Nov. 16,'97	113.0	17.0	83.0	22.30	26.86	------
712	Coulterville	H. H. Clark	Dec. 1,'97	113.0	15.0	85.0	18.24	21.46	------
735	Menlo Park	T. A. Donahoe	Dec. 23,'97	99.6	17.0	83.0	18.50	22.29	------
670	Nordhoff	S. C. Gridley	Nov. 18,'97	99.6	17.0	83.0	16.77	20.20	------

Analyses of Mission Olives—*Continued.*

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit.	Flesh	Per Cent of Oil.		
							In Whole Fruit	In Flesh	In Pit, ref'd to Whole Fruit
752	Nordhoff	B. F. Maddox	Mar. 2,'98	129.7	17.0	83.0	22.00	26.50	------
754	Nordhoff	W. S. Hall	Mar. 23,'98	81.6	12.0	88.0	17.55	19.94	------
744	Piru City	Piru Fruit Ranch	Jan. 11,'98	90.6	17.0	83.0	22.60	27.23	------
749	Simi	C. G. Austin	Jan. 22,'98	95.1	15.0	85.0	21.60	25.41	------
721	La Cañada	J. L. Lauterman	Dec. 4,'97	99.6	17.0	83.0	17.00	20.48	------
729	Fernando	C. N. Chase	Dec. 7,'97	95.1	18.0	82.0	19.92	24.29	------
649	Pomona	Frank Wiggins	Nov. 12,'97	122.0	18.0	82.0	15.32	18.68	------
730	Pomona	H. H. Wheeler	Dec. 7,'97	95.1	16.0	84.0	19.60	23.33	------
708	Grapeland	L. M. Breed	Nov. 27,'97	113.0	17.0	83.0	15.26	18.38	------
693	Murrietta	M. W. Burtt	Nov. 26,'97	77.1	15.0	85.0	17.48	20.56	------
713	Hemet	J. A. Brown	Dec. 4,'97	77.1	17.0	83.0	15.05	18.09	------
734	Lakeside	J. Perkins	Dec. 10,'97	72.6	15.0	85.0	13.10	15.41	------
676	Elsinore	Allen Dodd	Nov. 23,'97	143.2	17.0	83.0	18.31	22.06	------
750	Fallbrook	F. F. Adams	Feb. 7,'98	95.1	16.0	84.0	21.55	25.65	------
710	National City	Paul Thelen	Dec. 1,'97	117.0	16.0	84.0	18.45	21.96	------
641	San Diego	Dr. T. C. Stockton	Nov. 11,'97	77.1	14.0	86.0	17.00	19.76	------
753	Not given		Mar. 11,'98	99.6	17.0	83.0	19.10	23.01	------
	Average, 1897–1898 (28 samples)			115.7	16.3	83.7	17.89	21.75	------
	Average, 1896–1897 (38 samples)			116.7	18.1	81.9	19.68	23.92	------
	Average, 1894–1895 (32 samples)			112.2	16.7	83.3	17.20	21.45	------
	Average, 1891–1894 (14 samples)			130.1	19.6	80.4	18.77	22.94	.61
	Average, 1891–1898 (112 samples)			111.7	17.2	82.8	17.56	22.51	.61

NEVADILLO BLANCO, OR MOIRAL.

The Nevadillo Blanco came to California from Spain; probably there are importations from other countries also. From the descriptions we have, we are led to suppose that it is more vigorous and productive in California than in Europe. But it is the first to suffer from frost.

The tree is a vigorous, large spreading grower; gray bark; suckers ordinarily numerous; foliage when young very vigorous, inserted at an acute angle; color at first dirty greenish gray on the two-year-old wood; wood cylindrical, quadrangular only at the extremities of the young branches; eyes medium prominent. The leaf is medium long and wide (mean length, 6 to 7.5 centimeters, *i. e.* $2\frac{6}{16}$ to 3 inches; width, 1.25 to 1.75 centimeters, *i. e.* $\frac{8}{16}$ to $\frac{11}{16}$ inch); superior surface shining deep green; inferior with thick deposit, principal nerve well marked on both faces. The leaves are very plentiful, forming a thick covering to the tree.

The fruit is regularly distributed along the entire length of the branches, most frequently single, sometimes in pairs; peduncle short; pedicel long, inserted in a well-marked depression on the berry; stigma not apparent in well-marked umbilicus. This is an olive of under the medium size, or small. In California it is larger than in Europe; mean length in Europe is 1.5 to 1.66 centimeters, *i. e.* $\frac{10}{16}$ to $\frac{11}{16}$ inch; width, 1.25 to 1 5 centimeters, *i. e.* $\frac{8}{16}$ to $\frac{10}{16}$ inch. Its form is almost perfectly regular, with the exception that it is slightly obtuse at both extremities. The pit is large, and of the same shape as the berry, with a groove along its entire length. The skin is of a shining deep black color, rather thick, with very little bloom; pulp abundant, of a white-red color.

Out of fifty-eight, six samples of this variety were received from the culture substations of the University; thirty-one different localities furnished the remaining fifty samples.

The northern California, San Joaquin Valley, and southern California olives of this variety show remarkable similarity in oil content, all ranging between 21 and 22 per cent of oil in the flesh, or between 1 and 2 per cent lower than the average (22.92 per cent) for all localities. The Foothills, Bay, and southern Coast Range Nevadillos contain 25 to 26 per cent of oil in the flesh, the Bay fruit showing the highest average amount, 26.04 per cent. In size, there seems to be great regularity, with the exception of the Bay region fruit, which is the smallest, 215.9, and that from northern California the largest, 136.9 olives per pound. In the fruit from the Sierra Foothills, the San Joaquin Valley, the southern Coast Range, and southern California, none vary to any extent from the average of all in size, viz., 157 per pound.

With the exception of the Bay region fruit with 22 per cent, there is hardly any difference in *pit content* for the fruit of all the other regions, for the range is only between 16 and 17 per cent; the average for all is 17.3 per cent.

Compared with the Nevadillo Blanco as grown in France, that of California is found to be at least twice as large, and to contain only about four fifths as much pit and nearly two thirds more oil in the flesh. In Spain, the variety attains much greater size, requiring only 90.4 olives to weigh a pound; we have no figures for its oil content in other European countries.

The high yield of oil (the maximum for the common varieties) shown for the Nevadillo Blanco as raised on the varying soils of many different localities of California, and its habit of regular bearing, make it one of the olives best adapted for oil-making. Its size should make it as desirable for pickling as the Pendulina, Uvaria, Oblonga, and Rubra; but the Mission, being larger, is considerably better adapted for the purpose in question. Unfortunately it is, in many localities, liable to a bacterial disease causing soft decay of the fruit.

ANALYSES OF NEVADILLO BLANCO OLIVES.

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit.	Flesh.	Per Cent of Oil. In Whole Fruit	In Flesh	In Pit, ref'd to Whole Fruit
690	Oroville	J. G. Curtis	Nov. 24,'97	125.2	15.0	85.0	18.28	21.50	------
731	Lincoln	R. M. Manson	Dec. 7,'97	147.7	15.0	85.0	21.36	25.13	------
618	Amador	University	Nov. 8,'97	143.2	17.0	83.0	20.80	25.06	------
717	San José	W. Keith	Dec. 4,'97	125.2	20.0	80.0	18.76	23.56	------
607	Fresno	G. C. Roeding	Nov. 5,'97	93.7	14.0	86.0	15.00	17.44	------
624	Piru City	Piru Fruit Ranch	Nov. 9,'97	116.2	15.0	85.0	20.33	23.91	------
653	Pomona	E. C. Miner	Nov. 15,'97	143.2	17.0	83.0	13.82	16.07	------
600	Riverside	J. D. Patterson	Oct. 29,'97	116.2	15.0	85.0	20.30	23.88	------
601	Escondido	E. F. Ward	Oct. 30,'97	116.2	16.0	84.0	16.73	19.91	------
672	Escondido	E. F. Tabor	Nov. 18,'97	125.2	17.0	83.0	14.50	17.47	------
714	Hemet	J. A. Brown	Dec. 4,'97	129.7	14.0	86.0	15.55	18.08	------
643	San Diego	F. C. Stockton	Nov. 11,'97	138.7	17.0	83.0	13.75	16.56	------
604	Prospect Park	A. J. Milliken	Oct. 29,'97	143.2	18.0	82.0	20.03	24.42	------
	Average, 1897–1898			127.9	16.0	84.0	19.18	20.99	------
	Average, 1895–1896			150.7	16.7	83.3	20.44	24.04	------
	Average, 1894–1895			166.5	17.0	83.0	17.40	21.04	------
	Average, 1891–1894			157.5	20.5	79.5	19.85	24.83	1.08
	Average, 1891–1898 (57 samples)			157.3	17.3	82.7	19.21	22.92	.99

MANZANILLO.

The Manzanillo is found throughout Spain and southern France, where we are told it requires frequent regular pruning to insure regular crops. It ripens very early in the San Joaquin Valley, sometimes in October, but in the Bay region generally in November, sometimes as late as January.

The tree is vigorous and hardy; branches long, curved and light-colored. The secondary branches or twigs dry up when the fruit falls, which is very frequent. The fruit is large and apple-shaped, sometimes slightly elongated.

The chief difference thus far noted between the various kinds of Manzanillos is that in some cases the apple-like depression at the lower extremity of the fruit is more marked than in others, otherwise there seems to be little real difference.

Thirty-eight samples of the variety have been examined here; of this number five were received from the culture substations. Taking the average for the several regions of the State, it is found that the fruit of the San Joaquin Valley, while the largest in size, 82.3 to the pound, and carrying the smallest pit, 11.7 per cent, has but little more oil than that from southern California (16.55 per cent), and a smaller amount of oil (18.25 per cent) than the fruit from the Bay region with 20.86 per cent, the southern Coast Range with 21.10 per cent, or the Foothills with 21.57 per cent. The Foothill fruit is medium in size, 111.4 olives to the pound, those from the Bay region being the smallest, averaging 141.3 per pound. There is some little difference in the pit content of these fruits, as they have, respectively, 17.8 and 16 per cent. The southern Coast Range localities produce a small-sized fruit, 123.4, as compared with that from the San Joaquin Valley with 82.3, and that from southern California with 105.9 olives per pound. But in yield of oil the southern Coast Range fruit is superior, showing in the flesh 2.9 per cent more than the Valley and 4.6 per cent more than the southern California Manzanillo. The smallest Manzanillos, like the Missions, come from the Bay region, where upward of 140 olives of each of these varieties are necessary to make a pound. However, the Manzanillo contains only 20.86 as against 24.27 per cent of oil in the flesh of the Mission.

It appears, then, that for oil-making the Manzanillo from the Sierra Foothills reaches the best mark, and this upon a very well-drained, light soil. It also seems to do fairly for oil-making in the southern Coast Range region, although the Mission olive excels it there by over 2 per cent of oil, and in being at least one-fifth larger in size.

For pickling purposes the San Joaquin Valley Manzanillos are superior to all others in size. In pit content, or waste, they contain several per cent less than the others, and within about one half of one per cent of that (11.11) reported for the Manzanillo in its native country (Spain). According to our experiments, this olive, after passing through the pickling process, retains in its flesh nearly as much nourishment (oil) as we have found in the fresh Manzanillo of the south.

ANALYSES OF MANZANILLO OLIVES.

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit.	Flesh.	Per Cent of Oil.		
							In Whole Fruit	In Flesh	In Pit, ref'd to Whole Fruit
685	Amador	University	Nov. 24,'97	99.0	14.0	86.0	20.10	23.37	------
652	Bird's Landing	Mrs. J. B. Hoyt	Nov. 13,'97	189.0	20.0	80.0	15.68	19.60	------
606	Fresno	G. C. Roeding	Nov. 5,'97	67.5	11.0	89.0	13.25	14.88	------
751	Nordhoff	B. F. Maddox	Mar. 2,'98	112.5	14.0	86.0	27.42	31.81	------
720	La Cañada	J. S. Lauterman	Dec. 4,'97	108.0	13.0	87.0	16.43	18.88	------
636	Pomona	A. P. Simpson	Nov. 11,'97	117.0	18.0	82.0	15.97	19.47	------
677	Elsinore	Allen Dodd	Nov. 23,'97	81.0	15.0	85.0	15.25	17.94	------
673	Escondido	E. F. Tabor	Nov. 18,'97	90.0	12.0	88.0	15.05	17.10	------
602	San Diego	F. C. Stockton	Oct. 29,'97	121.5	10.0	90.0	13.59	15.10	------
	Average, 1897-1898			109.5	14.1	85.9	16.97	19.79	------
	Average, 1895-1896			94.9	12.0	88.0	16.59	19.04	.55
	Average, 1894-1895			108.3	14.20	85.80	16.60	19.35	------
	Average, 1891-1894			94.5	16.10	83.90	19.23	22.57	.55
	Average, 1891-1898 (38 samples)			106.2	14.7	85.3	16.94	19.73	.55

COLUMBELLA.

(Sometimes called Columella, but Columbella seems to be the proper name.)

The Columbella was imported from France by John Rock, of Niles. The general form of the fruit is broadly oval, $\frac{14}{16}$ of an inch long and $\frac{11}{16}$ of an inch thick; very even in size, and remarkable for the peculiar pale yellow color that the fruit assumes before turning purple; pit small, $\frac{8}{16}$ of an inch long and $\frac{5}{16}$ of an inch in thickness, straight and sharp-pointed. The pulp in pickling seems to part with its tartness slowly, but when properly prepared has a delicious flavor. It ripens late, sometimes after the broad-leaved Mission.

Twenty-five samples of this variety have been examined, and of the number four have come from the culture substations of the University. The fruit from the San Joaquin Valley shows the highest average amount of oil in the flesh, 23.39 per cent; the greatest departure from this being that found in the Sacramento Valley fruit, which had only 14.94 per cent of oil in the flesh. The analyses of Columbella from the other regions show the following results: That from the Foothills averages 22.78 per cent, the Bay region 21.61 per cent, the southern California 21.37 per cent, and the southern Coast Range 20.62 per cent. The southern fruit is the largest; the southern Coast Range averaging 83.8 and the southern California 93.8 olives per pound, both being over twice the size of the Bay fruit, which requires 163 per pound. The northern Foothills and the Valley fruit range very close to the average for all, viz., 114 per pound.

For pickling, the chief use to which the Columbella is put, it seems to improve toward the southern districts, where, especially in the southern Coast Range, it resembles the Valley Manzanillo in so far as its size goes. In localities south of Sacramento, it appears to be best adapted for oil-making, although it is not as rich in oil as the Mission by about 3 per cent on the average. Its oil, however, is of very good quality.

ANALYSES OF COLUMBELLA OLIVES.

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit.	Flesh.	Per Cent of Oil. In Whole Fruit	In Flesh	In Pit, ref'd to Whole Fruit
684	Amador	University	Nov. 24,'97	108.7	14.0	86.0	16.71	19.43	------
605	Fresno	G. C. Roeding	Nov. 5,'97	126.9	16.0	84.0	17.30	20.59	------
745	Piru City	Piru Fruit Ranch	Jan. 11,'98	81.6	15.0	85.0	18.15	21.35	------
603	Los Angeles	S. J. Milliken	Oct. 25,'97	95.1	18.0	82.0	14.10	17.19	------
635	Pomona	A. P. Simpson	Nov. 11,'97	95.1	15.0	85.0	18.85	22.17	------
654	San Diego	H. M. Stiles	Nov. 15,'97	99.6	16.0	84.0	12.54	14.86	------
	Average, 1897–1898			101.1	15.6	84.4	16.27	19.26	------
	Average, 1895–1897			104.4	16.4	83.6	17.28	20.68	------
	Average, 1894–1895			104.1	17.0	83.0	14.10	17.06	------
	Average, 1891–1894			186.7	18.4	81.6	15.31	18.77	.60
	Average, 1891–1898 (25 samples)			114.6	16.6	83.4	15.59	19.54	.60

RUBRA.

The Rubra was imported from France by John Rock, of Niles. It is somewhat like the Mission in general appearance. The fruit is ovate, slightly oblique, smaller than the Mission, $\frac{12}{16}$ of an inch long, $\frac{8}{16}$ of an inch thick; the pit is straight, pointed, $\frac{8}{16}$ of an inch long and $\frac{4}{16}$ of an inch thick; early maturity, ripening from three weeks to one month earlier than the Mission; jet-black in color when allowed to hang on the tree. The tree begins to bear early and is quite prolific.

Out of thirty-five samples of this variety examined here, three lots were received from the University culture substations. It yields its highest average of oil, 28.47 per cent, in the Sierra Foothills; that from the southern Coast Range averages 25.66 per cent; from the Bay, Valley, and southern California regions, the flesh of the fruit averages about 21.0 per cent of oil, or just about one per cent below the average for all. The northern California Rubras are, on the whole, the poorest in oil-bearing, showing only 18.07 per cent.; but in size they stand second, equaling those from the southern Coast Range, with 170.1 olives per pound. The largest fruit of this variety is produced in the San Joaquin Valley, where 156.3 olives make a pound. The average for all is 196.1. In the Bay region the Rubra is very small, averaging as many as 240.9 olives to the pound. By reference to the small table giving the variations between largest and smallest fruit, etc., it will be seen that the Rubra is not any more variable than most of the fully tested varieties.

The Rubra yields an oil of superior quality. Like the Manzanillo, it appears to be best adapted for oil-making in the well-drained soils of the Sierra Foothills. In the lower and richer lands of all the other regions, excepting the Coast Range, it does rather poorly, and in these places it never reaches the mark acquired by the Mission.

ANALYSES OF RUBRA OLIVES.

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit.	Flesh.	Per Cent of Oil. In Whole Fruit	In Flesh	In Pit, ref'd to Whole Fruit
732	Lincoln	R. M. Manson	Dec. 7,'97	235.5	21.0	79.0	22.05	27.91	------
743	Auburn	W. A. Hughes	Jan. 8,'98	240.0	20.0	80.0	21.75	27.18	------
627	Sacramento	W. D. Lawton	Nov. 9,'97	194.7	17.0	83.0	21.55	25.96	------
647	Sacramento	Olive Oil Co.	Nov. 11,'97	176.6	17.0	83.0	10.00	12.05	------
617	Amador	University	Nov. 8,'97	176.6	16.0	84.0	20.07	23.89	------
726	Piru City	Piru Fruit Ranch	Dec. 4,'97	155.0	18.0	82.0	20.17	24.60	------
695	Pomona	University	Nov. 26,'97	217.4	18.0	82.0	16.21	19.76	------
656	San Diego	H. M. Stiles	Nov. 15,'97	217.4	18.0	82.0	14.11	17.20	------
	Average, 1897-1898			201.6	18.1	81.9	18.23	22.94	------
	Average, 1895-1897			203.8	18.1	81.9	18.82	23.24	------
	Average, 1894-1895			190.2	17.5	82.5	16.86	20.17	.75
	Average, 1891-1894			184.8	17.8	82.2	18.33	22.28	.82
	Average, 1891-1898 (35 samples)			196.1	17.8	82.2	18.58	22.01	.75

REDDING PICHOLINE.

The "Redding Picholine" was imported from France by the late B. B. Redding. It was imported for the large pickling olive known in France as the Picholine, and very highly esteemed there for that purpose, as well as for the small quantity of high-grade oil it yielded. For a long time it was supposed that the Redding Picholine was after all the true Picholine of Europe. Reference to the description of the true Picholine will show that this is an error, the fruit being very much smaller, as well as different in shape.

The olive is perfectly oval in shape, $\frac{8}{16}$ of an inch long and $\frac{4}{16}$ of an inch thick; ripens early, several weeks sooner than the Mission; is dark purple or black in color. In pickling, the pulp loses its bitterness quickly, the fruit being pleasant to the taste.

Out of the forty-two samples of this variety examined, four have come from the culture substations of the University.

In production of oil, the Bay region fruit leads, as we find its flesh to contain an average of 24.43 per cent, the fruit from the other regions standing as follows: Foothill fruit, 21.79; Valley, 21.47; southern Coast Range, 21.63; northern California, 19.51; southern California, 17.82; the general average being 20.83 per cent of oil in the flesh.

The largest specimens, on the average, have been received from north of Sacramento; those from the Foothill region requiring 341.1 olives, and those from the former 322.5 olives to the pound. The Coast region fruit is by far the smallest, especially that from the southern Coast Range region, where as many as 452 olives are required to weigh a pound. The general average, 398.2 olives to the pound, is pretty closely followed by the Bay region fruit with 416.8, the southern California fruit with 373.4, and that of the San Joaquin Valley with 353.3.

The Foothill fruit contains the least pit, 20.8 per cent. Excepting this, the variations on either side of the general average, 23.0 per cent, are between one and two per cent.

Nothwithstanding the rather abundant yield of oil shown by this variety from all over the State (only 1.6 per cent, on the average, less than the Mission), the fact that its oil is very poor in quality, and on account of the extreme difficulty in keeping it clear and brilliant, it is undesirable for oil-making. For pickling it is unsuitable, not alone because it is the smallest of all the commonly-grown olives, but also because it has such a large pit.

Having gained a place in the olive orchards of the State by being mistaken for the true Picholine of Europe, it only remains to speak of the use it may be made of, and this is best given, perhaps, in the following statement: "The tree is such an excellent grafting-stock that it can be readily grafted into just as prolific varieties, which do not possess the same faults."

ANALYSES OF REDDING PICHOLINE OLIVES.

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit.	Flesh.	Per Cent of Oil. In Whole Fruit	Per Cent of Oil. In Flesh	Per Cent of Oil. In Pit, ref'd to Whole Fruit
648	Hengy	Frank Logue	Nov. 12,'97	405.0	26.0	74.0	10.05	13.58	------
689	Oroville	W. A. Beard	Nov. 24,'97	351.0	22.0	78.0	13.97	17.91	------
691	Oroville	J. G. Curtis	Nov. 24,'97	265.5	17.0	83.0	14.72	17.73	------
674	Auburn	F. Birdsall	Nov. 20,'97	270.0	19.0	81.0	16.51	20.38	------
711	Colfax	J. G. Howell	Dec. 1,'97	405.0	20.0	80.0	16.89	21.11	------
663	Routier	M. C. Pike	Nov. 17,'97	310.0	22.0	78.0	18.79	24.09	------
612	Amador	University	Nov. 8,'97	382.5	22.0	78.0	20.20	25.90	------
651	Bird's Landing	Mrs. J. B. Hoyt	Nov. 13,'97	391.5	22.0	78.0	14.57	18.68	------
661	Oakdale	Haslacher & Kahn	Nov. 16,'97	328.5	22.0	78.0	19.62	25.12	------
722	La Cañada	J. L. Lauterman	Dec. 4,'97	351.0	22.0	78.0	14.35	18.39	------
699	Pomona	University	Nov. 26,'97	378.0	24.0	76.0	9.39	12.35	------
	Average, 1897–1898			348.9	21.6	78.4	15.36	19.56	------
	Average, 1895–1897			373.5	23.1	76.9	17.82	23.19	------
	Average, 1894–1895			404.5	21.8	78.2	13.33	17.11	------
	Average, 1891–1894			355.5	24.4	75.5	18.64	24.65	1.52
	Average, 1891–1898 (42 samples)			398.4	23.0	77.0	16.18	20.83	1.52

PICHOLINE (TRUE PICHOLINE OF EUROPE).

The tree is of medium vigor and dimensions, and a spreading grower; trunk cylindrical; bark detaches easily from the trunk in regular strips; branches grow horizontally or with a slight upward inclination; very few suckers; foliage not vigorous, thick, growing at right angles to the main stem, of a yellowish gray color; wood cylindrical or slightly flattened; eyes prominent.

Leaves oval, frequently wider at the upper part; medium length, and above medium width ($5\frac{1}{2}$ to $6\frac{1}{2}$ centimeters in length, *i. e.* $2\frac{3}{16}$ to $2\frac{10}{16}$ inches; $1\frac{1}{2}$ to $1\frac{3}{4}$ centimeters in width, *i. e.* $\frac{10}{16}$ to $\frac{11}{16}$ inch); upper surface dull deep green; lower surface with slight dirty white pubescence; well-marked nerves on lower surface; peduncle thick, long, straight. The leaf is flat at the edges. The young branches are heavily covered with leaves.

The fruit is generally accumulated near the lower part of the wood of the year, single or in bunches of two; pedicels very short; stigma persistent in a very slight umbilicus. The fruit is above the usual size (mean length, $2\frac{1}{2}$ to 3 centimeters, *i. e.* 1 to $1\frac{3}{16}$ inches; width, 1 to $1\frac{1}{2}$

centimeters, *i. e.* $\frac{6}{16}$ to $\frac{10}{16}$ inch). The form is ovoid and elongated, but thickest near the peduncle, coming to a point near the upper extremity. It is very much curved, of a form intermediate between that of the Lucques on one hand, and the Oliviere on the other The fruit passes from a clear green to a reddish-black; very little bloom, thin skin. Pit small, long, and pointed, being of the same shape as the fruit; maturity medium.

The true Picholine is widely known in France, especially in the neighborhood of Aix, Tarascon, and Marseilles, and throughout the Languedoc. It yields good crops with tolerable regularity. It is a variety of medium hardiness, but stands very heavy pruning. In France it is cultivated chiefly for pickles, although it yields a fair amount of high-grade oil. Its great delicacy makes it highly esteemed for pickles, which are generally sold under the name of Lucques. It and the Verdale are the best eating varieties of that country.

In California the general belief seems to be that the Picholine is the same variety as the Oblonga. There is certainly a strong resemblance between the two. Below we give all the comparative data at hand relating to the analysis of the Picholine of Europe and as grown in California, the averages for 32 samples of Oblonga and 42 of Redding Picholine.

ANALYSIS OF PICHOLINES.

	PICHOLINE.		OBLONGA.	REDDING PICHOLINE.
	France.	California.*	California.	California.
Number of olives per pound	104.2	77.0	179.4	398 2
Pit, per cent	10.9	17.5	18.7	23.00
Oil, per cent in flesh	17.0	21.18	15.68	20 83

* Average of two samples.

From the above, it seems that there should be no confusion of the true Picholine with either the Oblonga or the Redding Picholine. We find it here to be of the same size grown at both extremes (northern and southern) of the regional limits of the olive, and with a difference of only 4 per cent of oil in the flesh. As is to be expected, and shown above, the California Picholine is considerably larger than that grown in France, and yields on the average some 4 per cent more of oil.

In size, the Picholine, with 77.0 olives, rates favorably with the San Joaquin Valley (Fresno) Manzanillo, which requires 82.3 olives per pound. In quantity of oil in the flesh it leads these Manzanillos by almost 3 per cent, but in pit it falls behind, having more by 5.8 per cent—just about the difference recorded above for the Picholines of France and California. Compared with the Lucques of California growth, our Picholine is over twice as large, and in nearly every case carries less pit. The only sample out of six Lucques which has more oil than the Picholine is that from Amador, with 24.53 per cent. The Lucques is a variety frequently confounded with the Picholine, and is known mostly in Europe in localities where pickling is the chief industry.

The Picholine with us excels the Verdale in size, for it takes 114.5 olives of the latter on the average to weigh a pound; but the Verdale has a smaller pit and is higher in oil by one per cent in each case than the Picholine. The Verdale is a Languedoc variety found throughout France and highly esteemed for pickles.

The Sevillano, the largest olive examined here and one of the largest olives known, attains a size double that of the true Picholine; requiring only 36 as against 77 Picholine olives per pound, and this with a materially smaller pit. In oil content there is practically no choice between these two varieties. The Sevillano in southern California grows to be as large as in Spain.

The records relating to these preëminently pickling varieties, while meager, at least offer a sufficient reason for recommending them to the grower for more general trial.

OBLONGA.

The oblonga was imported from France by John Rock, of Niles. It is an olive of peculiar club-like shape, being narrow at the stem end, broad at the upper end, rounded and slightly oblique, $\frac{15}{16}$ of an inch long and $\frac{8}{16}$ of an inch thick. The pit is curved, $\frac{11}{16}$ of an inch long by $\frac{4}{16}$ of an inch thick, and generally pointed at both ends. The pulp loses its tartness comparatively quickly in pickling, and is very pleasant to the taste, qualities which recommend it especially as a pickling variety. It ripens at least two weeks earlier than the common broad-leaved Mission. Its color is dark purple. It is commonly supposed that the Oblonga is the same as the true Picholine of Europe, but there seems to be little foundation for this belief, as the two varieties are quite distinct.

Thirty-two lots of this variety have been examined; out of this number five were from the University culture substations.

In oil, the southern Coast Range fruit leads, with an average of 19.05 per cent in the flesh; but shows little advantage over the southern California fruit, which has an average of 17.99 per cent. Coming north into the San Joaquin Valley region, it is found that the oil content, 12.25 per cent, falls below that noted above. The olives of the Bay region and the Sacramento Valley both show higher contents of oil (respectively 16.48 and 15.64 per cent) than the San Joaquin Valley. The general average is 15.68 per cent.

This fruit is a little larger in the Sacramento region than in the San Joaquin Valley or in southern California, the figures being respectively 135.9, 142, and 154 olives per pound; from the Bay region 212, and from the southern Coast Range 193.5, olives are required for a pound. There is little variation in pit content in the fruit from the different regions; the average being 18.7 per cent.

Although the quality of its oil is very good, this variety is not at all well adapted for oil-making in the Great Valley region; and at best is not more than medium for the purpose. For pickling, the valley fruit would be the best if size were alone considered, but its low oil content would not indicate a very nourishing product; therefore, all things considered, the Oblonga from the south would appear to be the best. It has the reputation of having a delicately flavored flesh. One of its peculiarities seems to be that the volume of the flesh diminishes very much during the process of pickling, so that when pickled, the percentage of pit seems to be greater than that indicated by analysis.

ANALYSES OF OBLONGA OLIVES.

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit.	Flesh.	Per Cent of Oil.		
							In Whole Fruit	In Flesh	In Pit, ref'd to Whole Fruit
697	Pomona	University	Nov. 26,'97	154.0	18.0	82.0	12.06	14.77	......
669	Orange	G. Bixby	Nov. 17,'97	158.5	17.0	83.0	14.35	17.37	......
657	San Diego	H. M. Stiles	Nov. 15,'97	180.2	20.0	80.0	14.22	17.77	......
	Average, 1897–1898			164.2	18.3	81.7	13.54	16.63	......
	Average, 1895–1897			152.4	18.6	81.4	15.01	18.13	......
	Average, 1894–1895			167.6	19.1	80.9	10.00	17.33	.83
	Average, 1891–1894			183.8	19.0	81.0	13.63	17.02	.90
	Average, 1891–1898 (32 samples)			179.4	18.7	81.3	13.34	15.68	.85

UVARIA.

The Uvaria was imported from France by John Rock, of Niles. The fruit is oval, regular, and rounded at both ends, $\frac{13}{16}$ of an inch long and $\frac{9}{16}$ of an inch in thickness; pit straight and heavy, $\frac{10}{16}$ of an inch in length and $\frac{6}{16}$ of an inch in thickness. It ripens later than the common Mission olive; color dark purple or black when ripe. The name "grape-like" is well chosen, the fruit growing in clusters, as many as seven together, and resembling the grape in shape. The Uvaria is very prolific.

Twenty-nine samples of this variety have been examined at this laboratory; of these, three were grown at the University culture substations. The Foothill, southern California, and Bay fruits each average 20.5 per cent of oil in the flesh; Sacramento Valley and southern California fruits both average 17.5 per cent, and that in the San Joaquin Valley, 15.4 per cent of oil; the average for the Uvaria from all localities is 18.51 per cent. The largest fruit comes from the southern Coast Range, 133.6 olives to the pound; the smallest from the Bay region, where 258.9 olives weigh a pound; in other regions the general average is 205.1 olives per pound. In pit content the Uvaria exceeds all other common varieties, carrying 8 per cent more than either the average Mission or the Nevadillo.

Its low yield of oil in the San Joaquin Valley would mean that it is a poor variety for oil-making there; and even where it does its best, it never comes up to the Mission in yield of oil.

ANALYSES OF UVARIA OLIVES.

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit.	Flesh.	Per Cent of Oil.		
							In Whole Fruit	In Flesh	In Pit, ref'd to Whole Fruit
733	Lincoln	R. M. Manson	Dec. 7,'97	231.0	31.0	69.0	13.90	20.14	......
609	Amador	University	Nov. 8,'97	153.0	24.0	76.0	14.30	18.82	......
626	Sacramento	W. D. Lawton	Nov. 9,'97	184.7	27.0	73.0	13.22	18.11	......
646	Sacramento	Sac'to Olive Co.	Nov. 11,'97	158.5	23.0	77.0	10.66	13.84	......
623	Piru City	Piru Fruit Ranch	Nov. 9,'97	135.9	26.0	74.0	15.10	20.35	......
658	San Diego	H. M. Stiles	Nov. 15,'97	226.5	28.0	72.0	15.57	21.62	......
	Average, 1897–1898			197.9	26.5	83.5	13.79	18.66	......
	Average, 1895–1897			167.6	24.5	75.5	15.05	19.99	......
	Average, 1894–1895			240.0	26.2	73.8	13.06	17.76	1.08
	Average, 1893–1894			172.1	24.6	75.3	11.38	15.08	......
	Average, 1891–1898 (29 samples)			205.1	25.5	74.5	13.71	18.51	1.07

PENDULINA.

The Pendulina was imported from France by John Rock, of Niles. The fruit is of an even oval shape, rounded at both ends, quite variable in size, many fruits remaining small and undeveloped; it is $\frac{12}{16}$ of an inch long and $\frac{9}{16}$ of an inch thick; the pit is $\frac{7}{16}$ of an inch long. $\frac{4}{16}$ of an inch thick, exclusive of the small, sharp points often found at both ends. The fruit grows in clusters of two to five; the pulp parts very readily with its tartness. This variety must not be confounded with the Pendoulier, which is somewhat larger, and more of an ovate shape.

Twenty-two samples of this variety have been tested; five from the culture substations of the University. For oil-making, the Pendulina is found to reach its best in the southern part of the State, where it averages 23.0 per cent of oil in the flesh. In the San Joaquin Valley it apparently does not produce a high amount of oil, giving only 18.21 per cent on the average, which is considerably less than is yielded by the fruit from the Sacramento Valley (21.88) and southern California (22.11).

For pickling, the southern-California-grown Pendulina is the best, because of its size, but in this it falls much below the southern Mission, for 141.3 are required to make a pound, while only 100.2 of the Mission are necessary.

ANALYSES OF PENDULINA OLIVES.

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit.	Flesh.	Per Cent of Oil. In Whole Fruit	In Flesh	In Pit, ref'd to Whole Fruit
644	Sacramento	Olive Oil Co.	Nov. 11,'97	144.9	14.0	86.0	12.14	14.12	------
622	Piru City	Piru Fruit Ranch	Nov. 9,'97	153.9	13.0	87.0	20.60	23.67	------
642	San Diego	F. C. Stockton	Nov. 11,'97	126.8	12.0	88.0	15.57	17.80	------
	Average, 1897-1898			141.8	13.0	87.0	16.10	18.53	------
	Average, 1894-1895			169.8	13.4	86.6	16.11	18.60	.93
	Average, 1891-1894			95.1	14.2	85.8	15.40	21.50	.98
	Average, 1891-1898 (22 samples)			157.5	13.7	86.3	18.63	21.36	.96

OTHER VARIETIES.

Razzo.—The Razzo is mainly cultivated in the provinces of Lucca and Pisa, together with Mignolo, Morajolo, and Grossajo. The fruit is roundish, fleshy, and contains more oil (in Italy) than any of the native Italian varieties, on which account it is called by the peasants "frantojani," or oil-press olive. The Razzo commences to ripen in November or December. The soils that suit it best are those that are deep, rich, and well-drained. It suffers from the cold, fogs, and winds of the lowlands, preferring the protected hillsides. Though it is exceptionally fertile, it drops its fruit very readily, especially when exposed to winds or prolonged hot spells.

In California this fruit, from seven widely separated localities (from central to southern California) shows the highest average yield of oil, 32.82 per cent, from the Santa Clara Valley; at Pomona it averages 30.30 per cent; in the Sierra Foothills, 26.76 per cent; and at Tulare, in the San Joaquin Valley, it produces only 23.48 per cent of oil. The general average of ten samples is 28.42 per cent of oil in the flesh. In size, like most of the Italian varieties grown here, it averages about one half that of the Mission; but it contains more pit than the latter, carrying 24.3 per cent.

Grossajo.—As compared with the Grossajo grown in the Santa Clara Valley, the Razzo produces a little less oil, 1.50 per cent on the average; while the Pomona-grown Grossajo falls below the average Razzo some 5.0 per cent in oil.

Cucco.—The Cucco averages at Santa Barbara 34.0 per cent of oil in the flesh, or 1.3 per cent more than the best Razzo, *i. e.* that of the Santa Clara Valley. At Pomona, the "Cucco" with 31.7 per cent and the Razzo with 30.5 per cent appear to be very much alike in oil production. In the Santa Clara Valley it does poorly, averaging only 21 per cent in the flesh.

Corregiolo.—The Corregiolo, at Santa Barbara, averaged for four different seasons 32.52 per cent of oil, a figure very similar to that of the Razzo at its best in California. In the Santa Clara Valley it produces 24 per cent, while in Tulare, in the San Joaquin Valley, it attains but 18.81 per cent of oil.

Leccino.—The Leccino, a hardy Tuscan variety, which produces in its native home a low-grade oil—one hard to clarify and of inferior taste—gives its highest yield of oil, 35.12 per cent, at Santa Barbara (averaging there 30 per cent). Other southern localities, Pomona and Orange, show nearly 31 per cent of oil in the flesh. In the north it falls below this some 5 per cent, carrying but 26 per cent of oil.

As far as the record goes, these Italian varieties away from the Great Valley, especially on low mesa soils, where they have received the most attention, give great promise of becoming of high importance for oil-making. Generally, they yield oil of the best quality; which should also commend them to the grower for more general and extensive trial.

ANALYSES OF OTHER OLIVE VARIETIES.

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit.	Flesh.	Per Cent of Oil.		
							In Whole Fruit	In Flesh	In Pit, ref'd to Whole Fruit
	ATROVIOLACEA.								
611	Amador	University	Nov. 8,'97	172.1	21.0	79.0	16.55	20.95	......
638	Pomona	University	Nov. 11,'97	185.7	20.0	80.0	19.70	24.62	......
665	Orange	G. Bixby	Nov. 17,'97	194.7	21.0	79.0	19.47	24.64	......
	Average			184.1	20.6	79.4	18.57	23.40	......
	Average, 1891-1898 (19 samples)			206.9	22.5	77.5	17.55	22.40	1.08
	PRÆCOX.								
608	Amador	University	Nov. 8,'97	158.0	17.0	83.0	15.09	18.18	......
706	Pomona	University	Nov. 26,'97	236.5	18.0	82.0	20.20	24.63	......
	Average			192.2	17.5	82.5	17.64	21.40	......
	Average, 1891-1898 (15 samples)			196.1	19.2	80.8	14.34	17.75	.84
	POLYMORPHA.								
616	Amador	University	Nov. 8,'97	63.4	15.0	85.0	19.48	22.89	......
640	Pomona	University	Nov. 11,'97	63.4	14.0	86.0	17.30	20.11	......
	Average			63.4	14.5	85.5	18.39	21.50	......
	Average, 1891-1898 (14 samples)			71.9	17.1	82.9	15.85	18.82	.88

ANALYSES OF OTHER OLIVE VARIETIES—*Continued.*

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit.	Flesh.	Per Cent of Oil.		
							In Whole Fruit	In Flesh	In Pit, ref'd to Whole Fruit
	MACROCARPA.								
610	Amador	University	Nov. 8,'97	77.0	16.0	84.0	16.98	20.20	
624	Piru City	Piru Fruit Ranch	Dec. 4,'97	81.5	19.0	81.0	19 40	23.95	
639	Pomona	University	Nov. 11,'97	77.0	16.0	84.0	18.24	21.71	
	Average			78.5	17.0	83.0	17.87	21.95	
	Average, 1891–	1898 (12 samples)		72.8	17.5	82.5	14.70	20.41	.70
	SALONICA.								
687	Amador	University	Nov. 24,'97	126.8	15.0	85.0	20.19	23.75	
698	Pomona	University	Nov. 26,'97	126.8	16.0	84.0	17.68	21.03	
	Average			126.8	15.5	84.5	18.93	22.39	
	Average, 1891–	1898 (9 samples)		166.2	16.1	83.9	20.04	23.60	.55
	REGALIS.								
686	Amador	University	Nov. 24,'97	113.2	16.0	84.0	19.46	23.16	
715	San José	W. Keith	Dec. 4,'97	81.5	17.0	83.0	16.25	19.57	
619	Piru City	Piru Fruit Ranch	Nov. 9,'97	77.0	16 0	84.0	16.58	19.74	
	Average			90.6	16.3	83.7	17.43	20.82	
	Average, 1891–	1898 (12 samples)		112.5	16.3	83.7	16.37	19.58	.96
	NIGERINA.								
615	Amador	University	Nov. 11,'97	140.4	16.0	84.0	23.85	28.40	
678	Amador	University	Nov. 24,'97	81.5	14.0	86.0	19.37	22.52	
697	Amador	University	Nov. 24,'97	140.4	17.0	83.0	23.10	27.83	
728	Nordhoff	W. L. Hall	Dec. 7,'97	276.3	25.0	75.0	18.65	24.86	
	Average			159.6	18.0	82.0	21.24	25.90	
	Average, 1891–	1898 (12 samples)		160.0	17.5	82.5	19.96	26.16	1.06
	ATRORUBENS.								
709	Palermo	S. J. Nunn	Nov. 27,'97	158.5	24.0	76.0	13.64	17.94	
681	Amador	University	Nov. 24,'97	154.0	16.0	84.0	25.97	30 92	
747	Piru City	Piru Fruit Ranch	Jan. 11,'98	149.5	15.0	85.0	24.15	28.41	
	Average			154.0	18.3	81.7	21 25	25.75	
	Average, 1891–	1898 (11 samples)		115.4	16.9	83 1	19.14	25.59	.75
	CORREGIOLO.								
628	Santa Barbara	F. S. Gould	Dec. 1,'97	190.2	19.0	81.0	23.20	28.64	
	Average, 1891–	1898 (11 samples)		262.7	25.8	74.2	21.15	27.68	1.24
	RAZZO.								
	Average, 1891–	1897 (10 samples)		216.4	24.3	75.7	21.10	28.42	.84
	FRANTOJO.								
633	Santa Barbara	F. S. Gould	Dec. 1,'97	199.3	20.0	80.0	27.05	33.81	
	Average, 1891–	1898 (7 samples)		298.9	25 9	74.1	24 10	33.94	1.00
	MORINELLO.								
631	Santa Barbara	F. S. Gould	Dec. 1,'97	199.3	17.0	83.0	21.85	26.32	
705	Pomona	University	Nov. 26,'97	207.4	20.0	80.0	20.05	25.06	
	Average			203.3	18.5	81.5	20.92	25.69	
	Average, 1891–	1898 (8 samples)		287.9	23.1	76.9	21.60	28.90	1.00
	CUCCO.								
629	Santa Barbara	F. S. Gould	Dec. 1,'97	231.0	25.0	75.0	29.47	39.29	
748	Piru City	Piru Fruit Ranch	Jan. 11,'98	81.4	19.0	81.0	32.55	40.18	
702	Pomona	University	Nov. 26,'97	208.3	26.0	74.0	23.51	31.77	
	Average			173.5	23.3	76.7	28.51	37.08	
	Average, 1891–	1898 (8 samples)		192.9	21.1	78.9	27.22	34.38	.70
	LECCINO.								
630	Santa Barbara	F. S. Gould	Dec. 1,'97	253.6	20.0	80.0	20.74	25.92	
704	Pomona	University	Nov. 26,'97	172.1	20.0	80.0	20.20	25.25	
664	Orange	G. Bixby	Nov. 1,'97	158.5	22.0	78.0	24.13	30.94	
	Average			194.7	20.7	79.3	21.69	27.37	
	Average, 1891–	1898 (7 samples)		245.5	21.7	78.3	22.45	28.50	.95

Analyses of Other Olive Varieties—*Continued.*

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit	Flesh.	Per Cent of Oil.		
							In Whole Fruit	In Flesh	In Pit, ref'd to Whole Fruit
	PIANGENTE.								
	Average, 1891-	1897 (5 samples)	------	308.0	21.4	78.6	16.71	21.16	.86
	GROSSAJO.								
	Average, 1891-	1897 (6 samples)	------	242.3	25.7	74.3	23.96	32.78	1.03
	PALAZZUOLO.								
632	Santa Barbara	F. S. Gould	Dec. 1,'97	249.1	19.0	81.0	24.07	29.72	......
	Average, 1894-	1898 (5 samples)	------	272.1	22.2	77.8	29.34	37.70	.67
	MORCHIAIO.								
634	Santa Barbara	F. S. Gould	Nov. 10,'97	194.7	21.0	79.0	29.50	37.34	......
	Average, 1894-	1898 (4 samples)	------	238.2	23.0	77.0	29.34	37.99	.36
	INFRANTOJO.								
	Average, 1894-	1896 (2 samples)	------	389.5	25.0	75.0	15.10	20.04	.90
	MORAJOLO.								
	Average, 1893-	1895 (3 samples)	------	333.4	33.0	67.0	21.74	32.22	1.45
	LAYIGNANO.								
613	Amador	University	Nov. 8,'97	199.2	27.0	73.0	27.50	37.67	......
	Average, 1895-	1898 (4 samples)	------	239.6	24.2	75.8	24.28	31.90	......
	MIGNOLO.								
504	Berkeley	University	Jan. 27,'96	227.5	12.0	88.0	16.50	18.75	......
	LUCQUES.								
680	Amador	University	Nov. 24,'97	235.6	27.0	73.0	17.91	24.53	......
	Average, 1893-	1897 (6 samples)	------	192.9	23.0	77.0	14.81	17.21	1.09
	PLEUREUR DE	GRASSE.							
	Average, 1895-	1897 (7 samples)	------	171.2	18.5	81.5	22.04	26.65	.74
	VERDALE.								
700	Pomona	University	Nov. 26,'97	117.7	18.0	82.0	17.69	21.57	......
	Average, 1894-	1897 (5 samples)	------	114.5	16.7	83.3	19.05	22.53	.65
	PICHOLINE.								
	Average, 1894-	1895 (2 samples)	------	77.0	17.5	82.5	17.83	21.18	.72
	ASCOLANO.								
620	Piru City	Piru Fruit Ranch	Nov. 9,'97	54.3	12.0	88.0	19.09	21.69	......
	Average, 1894-	1897 (5 samples)	------	60.6	12.0	88.0	16.26	18.45	.57
	CAILLON.								
	Average, 1895-	1896 (2 samples)	------	178.5	20.0	80.0	16.95	21.19	......
	OBLIZA PENDUL	IER.							
493	Berkeley	University	Jan. 16,'96	176.3	20.0	80.0	12.33	15.41	......
	OBLIZA.								
	Average, 1895-	1897 (4 samples)	------	105.2	14.6	85.4	11.23	13.42	.37
	AMELLAU.								
	Average, 1893-	1896 (4 samples)	------	120.0	16.5	83.5	15.67	16.51	.59
	AMYGDALINA.								
682	Amador	University	Nov. 24,'97	77.0	15.0	85.0	15.32	18.02	......
	Average, 1894-	1897 (2 samples)	------	76.9	15.0	85.0	19.90	23.41	......
	EMPELTRE.								
	Average, 1894-	1896 (3 samples)	------	111.4	15.7	84.3	19.86	22.93	.75
	HERVAZA.								
	Average, 1894-	1896 (3 samples)	------	197.0	15.0	85.0	14.39	17.22	.37
	HUFF'S SPANISH.								
	Average, 1895-	1896 (2 samples)	------	425.8	25.0	75.0	16.50	21.99	.99

ANALYSES OF OTHER OLIVE VARIETIES—*Continued.*

Number	Locality.	Sender.	Date of Picking.	No. of Olives per Pound	Pit.	Flesh.	Per Cent of Oil.		
							In Whole Fruit	In Flesh	In Pit, ref'd to Whole Fruit
	BELLA DI SPAGNA.								
707	Pomona	University	Nov. 26,'97	190.2	24.0	76.0	19.76	26.00	------
	Average, 1894–1897 (2 samples)		------	151.4	22.5	77.5	18.75	23.94	------
	OLEA MARIA.								
	Average, 1894–1896 (2 samples)		------	194.7	20.5	79.5	17.85	22.88	.77
	SWEET OLIVE.								
621	Piru City	Piru Fruit Ranch	Nov. 9,'97	194.7	12.0	88.0	11.22	12.75	------
	Average, 1895–1897 (3 samples)		------	213.9	15.3	84.7	12.04	13.96	------
	BELLMONTE.								
696	Pomona	University	Nov. 26,'97	154.0	20.0	80.0	15.60	19.50	------
	Average, 1895–1897 (2 samples)		------	157.1	20.0	80.0	17.74	20.30	------
	DALMATIAN.								
	Average, 1894–1896 (2 samples)		------	120.0	17.5	82.5	15.92	18.92	.63
	ASCOLI.								
	Average, 1894–1896 (2 samples)		------	113.2	16.0	84.0	16.89	19.72	.54
	QUEEN.								
727	Piru City	Piru Fruit Ranch	Dec. 4,'97	147.7	26.0	74.0	23.90	32.29	------
	Average, 1894–1897 (2 samples)		------	140.1	24.0	76.0	26.67	36.30	------
	SANTA CATERINA.								
746	Piru City	Piru Fruit Ranch	Jan. 11,'98	90.6	20.0	80.0	28.3	36.62	------
	Average, 1894–1898 (5 samples)		------	100.1	18.2	81.8	17.91	20.09	.52
	SEVILLANO.								
637	Pomona	University	Nov. 11,'97	45.3	13.0	87.0	15.26	17.54	------
	Average, 1894–1897 (2 samples)		------	36.2	14.5	85.5	17.23	20.19	.40
	ATTICA.								
666	Orange	G. Bixby	Nov. 17,'97	176.3	20.0	80.0	15.91	19.79	------
	OLIVASTRO.								
703	Pomona	University	Nov. 26,'97	172.1	28.0	72.0	21.11	29.32	------
667	Orange	G. Bixby	Nov. 17,'97	149.5	22.0	78.0	22.00	28.27	------
	Average	------	------	160.4	25.0	75.0	21.55	28.79	------
	RUFA.								
614	Amador	University	Nov. 8,'97	212.9	16.0	84.0	19.72	23.47	------
694	Pomona	University	Nov. 26,'97	226.5	18.0	82.0	21.00	25.61	------
	Average	------	------	219.2	17.0	83.0	20.36	24.54	------
	EVATELLA.								
660	Oakdale	Hashlacher & Kahn	Nov. 16,'97	162.7	17.0	83.0	23.85	28.73	------
	VARIETY UNKNOWN.								
737	Amador	University	Dec. 26,'97	453.0	35.0	65.0	23.85	36.23	------
738	Amador	University	Dec. 26,'97	837.0	45.0	55.0	17.02	30.95	------
739	Amador	University	Dec. 26,'97	326.1	23.0	77.0	23.25	30.19	------
740	Amador	University	Dec. 26,'97	126.5	35.0	65.0	18.90	29.08	------
741	Amador	University	Dec. 26,'97	675.0	40.0	60.0	15.07	25.11	------
742	Amador	University	Dec. 26,'97	702.0	60.0	40.0	9.10	22.75	------
716	San José	W. Keith	Dec. 4,'97	453.0	30.0	70.0	14.70	21.00	------
718	San José	W. Keith	Dec. 4,'97	317.1	37.0	63.0	13.51	21.45	------
719	San José	W. Keith	Dec. 4,'97	326.1	32.0	78.0	13.10	19.26	------
736	Santa Barbara	P. Kinevan	Dec. 26,'97	126.8	20.0	80.0	22.60	28.25	------
723	No. 12 Piru City	Piru Fruit Ranch	Dec. 4,'97	95.1	12.0	88.0	13.85	15.73	------
725	No. 6 Piru City	Piru Fruit Ranch	Dec. 4,'97	49.8	10.0	90.0	14.75	16.39	------
675	Penrose	------	Nov. 23,'97	113.2	16.0	84.0	19.31	22.99	------
758	Nordhoff	W. F. Hall	May 19,'98	126.8	13.0	87.0	17.43	20.03	------
701	Pomona	University	Nov. 26,'97	462.4	32.0	68.0	10.25	15.07	------

VARIATION IN SIZE OF FRUIT, AMOUNT OF PIT AND OIL.

The following table shows the variation in size, amount of pit and oil in the flesh in some of the common varieties of olives. The figures are so arranged as to indicate the relative differences between minimum and maximum in each variety, the minimum being the unit:

Ratio of Smallest to Largest Fruit, Pit and Oil.

Variety.	Size of Fruit.	Amount of Pit.	Oil in Flesh.
Mission	1:4.0	1:2.1	1:2.5
Nevadillo Blanco	1:3.7	1:1.9	1:2.4
Manzanillo	1:3.9	1:2.5	1:2.7
Redding Picholine	1:2.4	1:2.0	1:3.9
Columbella	1:4.0	1:2.0	1:2.2
Pendulina	1:2.0	1:2.1	1:3.1
Rubra	1:3.1	1:1.4	1:2.9
Uvaria	1:2.8	1:2.0	1:2.5
Oblonga	1:3.0	1:1.9	1:4.3
Atroviolacea	1:1.7	1:1.8	1:3.5
Præcox	1:3.5	1:1.5	1:2.5
Atrorubens	1:2.7	1:1.6	1:1.7
Polymorpha	1:2.5	1:1.4	1:2.2
Nigerina	1:4.2	1:2.8	1:1.7
Regalis	1:2.6	1:1.7	1:1.9

From whatever cause these variations arise, lack of adaptation of the variety to its locality, or the insufficiency of analytical data, it is a difficult matter, if not an impossible one, to name the variety which on the whole presents the least variations. For example, the best known variety, the Mission, shows comparatively great variation in size of fruit and only medium variation in oil and pit. The Redding Picholine, on the other hand, reverses the order of variation, and shows a greater variation, comparatively, in the matter of oil-bearing than in the quantity of pit or size of fruit.

The selection of proper varieties for planting in California is thus shown to have received only a part of the careful attention that the question demands. The necessity for, and the importance of, the work undertaken by the Station in bringing out and presenting all these various characteristics are forcibly shown.

The following table of averages by varieties gives the number of samples, the size of the fruit, the pit content, and the per cent of oil in the drupe, flesh, and pit of the various olives examined in the Station laboratory. This summary, together with the foregoing record, will afford a guide to the more intelligent use of the detailed record of analyses already in the hands of the interested grower, when studying varieties and making selections suitable to his soil (location) and climate:

AVERAGES BY OLIVE VARIETIES.

Variety.	No. of Samples Examined	Size; Number of Olives per Pound	Pit, Per Cent	Per Cent of Oil. In Whole Fruit	Per Cent of Oil. In Flesh	Per Cent of Oil. In Pit, ref'd to Whole Fruit
Varieties Fully Tested.						
Mission	112	111.6	17.2	17.56	22.51	.61
Nevadillo Blanco	57	157.3	17.3	19.21	22.92	.99
Manzanillo	38	106.6	14.7	16.94	19.73	.55
Redding Picholine	42	398.2	23.0	16.18	20.83	1.52
Uvaria	29	205.1	25.5	13.71	18.51	1.07
Rubra	35	196.1	17.9	18.58	22.01	.75
Oblonga	32	179.4	18.7	13.34	15.68	.85
Columbella	25	114.6	16.6	15.59	19.54	.60
Pendulina	22	157.1	13.7	18.63	21.36	.96
Varieties Not Yet Fully Tested.						
Atroviolacea	19	206.6	22.5	17.55	22.40	1.08
Præcox	15	196.1	19.2	14.34	17.75	.84
Polymorpha	14	71.9	17.1	15.85	18.82	.88
Macrocarpa	12	72.8	17.5	14.70	20.41	.70
Salonica	9	166.2	16.1	20.04	23.60	.55
Regalis	12	112.5	16.3	16.37	19.58	.96
Nigerina	12	160.0	17.5	19.96	26.16	1.06
Atrorubens	11	115.4	16.9	19.14	25.59	.75
Corregiolo	11	262.7	25.8	21.15	27.68	1.24
Razzo	10	216.5	24.3	21.10	28.42	.84
Frantojo	7	298.9	25.9	24.10	33.94	1.00
Morinello	8	287.9	23.1	21.60	28.90	1.00
Cucco	8	192.9	21.1	27.22	34.38	.70
Leccino	7	245.5	21.7	22.45	28.50	.95
Piangente	5	308.0	21.4	16.71	21.16	.86
Grossajo	6	242.3	25.7	23.96	32.78	1.03
Pallazzriolo	5	272.1	22.2	29.34	37.70	.67
Morchiaio	4	238.2	23.0	29.34	37.99	.36
Infrantojo	1	375.0	30.0	19.31	27.58	--------
Morajolo	3	333.4	33.0	21.74	32.22	1.45
Lavignano	4	239.6	24.2	24.28	31.90	--------
Mignolo	1	227.0	12.0	16.50	18.70	--------
Lucques	6	192.9	23.0	14.81	17.21	1.09
Pleureur de Grasse	7	171.2	18.5	22.04	26.65	.74
Verdale	5	114.5	16.7	19.05	22.53	.65
Picholine	2	77.0	17.5	17.83	21.18	.72
Ascolano	5	60.6	12.0	16.26	18.45	.57
Caillon	2	178.5	20.0	16.95	21.19	--------
Obliza Pendulier	1	176.3	20.0	12.33	15.41	--------
Obliza	5	105.2	14.6	11.23	13.42	.37
Amellau	4	120.0	16.5	15.67	16.51	.59
Amygdalina	2	76.9	15.0	19.90	23.41	--------
Empeltre	3	111.4	15.7	19.86	22.93	.75
Hervaza	3	197.0	15.0	14.39	17.22	.37
Bella di Spagna	2	151.4	22.5	18.75	23.94	--------
Huff's Spanish	2	425.8	25.0	16.50	21.99	.99
Olea Maria	2	194.7	20.5	17.85	22.83	.77
Sweet Olive	3	213.9	15.3	12.04	13.96	--------
Bellmonte	2	157.1	20.0	17.74	20.30	--------
Dalmatian	2	120.0	17.5	15.92	18.92	.63
Ascoli	2	113.2	16.0	16.89	19.72	.54
Queen	2	140.1	24.0	27.67	36.30	--------
Santa Caterina	5	100.1	18.2	17.91	20.09	.52
Sevillano	2	36.2	14.5	17.23	20.19	.40
Attica	1	176.3	20.0	15.91	19.79	--------
Olivastro	2	160.4	25.0	21.55	28.79	--------
Rufa	2	219.2	17.0	20.36	24.54	--------
Evatella	1	162.7	17.0	23.85	28.73	--------

In reviewing the records relating to the Mission, Nevadillo Blanco, Redding Picholine, Uvaria, Manzanillo, Oblonga, Rubra, Columbella, and Pendulina, there are sufficient data to warrant the statement that *these varieties as grown in the Bay region are all of smaller size than those from any of the other regions of the State, but generally they bear the largest percentages of oil*—in some of them the average is even higher than that of the same varieties in the Sierra Foothills. It would seem, then, that the cool bay climate does not affect the proper functioning of the drupe of these varieties.

In the Sacramento Valley on the north and southern California on the south, these olives have about the same size and the same richness in oil, showing that the climatic influences of the two sections are about alike, and that the natural moisture in the northern soils offsets that furnished by irrigation in the south. The southern Coast Range fruit has a more even distribution of the qualities in question, for it produces a fairly large fruit with more oil. In size, the San Joaquin Valley olives (excepting the Manzanillo, the largest fruit of those named) may be said to resemble the southern California fruit; with a tendency, on the whole, to yield less oil.

The records of analyses of the olives of the unusually dry season of 1894–95 show that this fruit was poor in size and in quantity of oil; many complaints of "failure of crop" reached the Station in 1898.

FURTHER NOTES ON OLIVE VARIETIES.

On February 6, 1899, samples of the following varieties of olives were received at the Experiment Station. They were kindly donated for experimental purposes by Mr. John Rock, of the California Nursery Company, and were grown in the orchard of the Nursery Company at Niles, Alameda County. The notes which accompany the list are the result of observations made in the orchard at the time:

1. *Picholine d'Aix.*—A fine, very large, deep black fruit, pointed at both ends, long and narrow in shape. Apparently a fine variety for pickling ripe. This is the large French Picholine olive, which is used for the manufacture of "olives farcies," for which it is particularly suitable on account of its free stone, which is easily removed after treatment with lye.
2. *Sevillano.*—Fruit extremely large (1¼ inches by ⅞ inch), of good *olive* shape, and well ripened. The trees are vigorous, and show a fair crop. The olives hang in groups of one, two, and three. This is the largest of the Spanish varieties, and that from which the best "Queen" olives are made.
3. *Uvaria.*—Fruit of good size, in bunches of three, four and five, well formed and well ripened. Some of the trees show a remarkably heavy crop; on others it is light where the crop is said to have been heavy the previous year. Trees strong and vigorous.
4. *Gordal.*—Fruit large (a little larger than the Mission), regular, cylindrical with blunt ends; well ripened and uninjured by frost. This is a very fine-looking olive, and the trees show good crops.
5. *Columbella.*—Fruit of fair size, but variable; varying also in color from yellowish pink to rose.
6. *Atrorubens.*—Fruit small to medium, dark red, irregularly ripened, and frostbitten.

7. *Regalis.*—Short oval, and varying in size. Similar in size and color to the Columbella. Usually greenish, tinged with brownish red.

8. *Oblonga.*—Small to medium in size, obovate and slightly curved; well ripened.

9. *Rubra.*—Small, ovate, dark red, ripe. Trees show good crops.

10. *Polymorpha.*—Large, long, curved; not quite ripe, and touched by the frost.

11. *Razzo.*—Medium size, long, oblong; ripe, but touched by the frost.

12. *Nevadillo Blanco.*—Medium size, well ripened; irregular in shape, but usually long and slightly curved.

13. *Leccino.*—Small to medium, cylindrical, ripe.

14. *Oliviere.*—Medium size, short oval, with a very marked apiculation or point at the end; ripe and firm.

15. *Ojo de Liebre.*—Of medium size; unripe and frostbitten.

16. *Mission.*—Medium to small; touched by frost, and not quite ripe.

17. *Da Salere.*—Large, short oval, with truncate base; similar to Manzanillo; quite ripe, but touched by frost.

18. *Pigale.*—Small, short oval-cylindrical; well ripened.

19. *Ascolano.*—Very large, short oval, with truncate base; ripe and shriveled.

20. *Verdale.*—Variety mixed.

21. *Pendulina.*—Medium size; well ripened, firm.

22. *Calamignara.*—No fruit left.

23. *Rouget.*—Small, short oval; well ripened.

24. *Solanengo.*—Medium to large, oval; touched by the frost.

25. *Itbafidena.*—Large to medium; not quite ripe, and touched by the frost.

26. *Amellau.*—Medium size, cylindrical, rose colored; not quite ripe.

27. *Corregiolo.*—Small, long obovate, ripe.

28. *Sarselena.*—Large, short oval; ripe and shriveled.

29. *Columbaro.*—Small and unripe.

30. *Grantois.*—Small, cylindrical, unripe.

31. *Canibana.*—Of medium size, shape of the Mission; unripe.

32. *Aglando.*—Small, unripe, obovate.

33. *Rapuina.*—Fruit seems identical with the preceding, but the leaves are broader.

34. *Da Olio.*—Large, oval, pointed; looks like a large Mission; quite ripe, but touched by frost.

35. *Manzanillo.*—Large to medium; somewhat shriveled and touched by frost.

36. *Sevillano Ocal.*—Large, oval, resembles Da Olio.

OLIVE CULTIVATION, OIL-MAKING, PICKLING, DISEASES.

(Revision of Bulletin No. 123.)

By F. T. Bioletti.

Nearly all of the publications of this Station relating to olives and olive-growing having been destroyed in the burning of the Agricultural Building, there are none now available for distribution. The present bulletin, therefore, has been prepared in answer to the numerous inquiries that are continually received. It is not intended as a manual of olive-growing, but only as a convenient summary covering the main points about which inquiries have been received.

CULTIVATION.

Climate.—The olive is a native of southern Europe, and has been cultivated in nearly all the countries surrounding the Mediterranean from time immemorial. From there it has spread to various countries which offer, like California, similar climatic conditions. It requires an average yearly temperature somewhat higher than is required by the vine, and will not withstand so low a temperature as the latter. It is dangerous to plant olive trees in any region where the temperature often falls below 20° F. Some varieties will withstand 15° F., but only for a short time; and the young wood of many varieties is injured even above this temperature. At 10° F. the whole tree is destroyed. In spring, after the new growth has started, much less cold than the above is harmful. On account of its need of an even climate the olive is seldom cultivated successfully more than one hundred miles from the sea, and succeeds best where the mean temperature of the coldest month does not fall below 43° F.

Soil.—The olive needs a light, well-drained soil, and either does not succeed, or gives fruit of poor quality, on heavy, clayey, or ill-drained soils. It is especially suited to sandy or loam soils rich in lime, and will grow in soils so rocky that nothing else but a vine could succeed in them. It is a mistake, however, to suppose that the olive will give profitable crops in poor soils; such soils must be well fertilized to insure good growth of the young trees and good crops on the old.

The olive requires less water than many cultivated trees, on account of its light foliage, and of its strong root-system, which penetrates to a great depth even in very rocky subsoils, if well drained. It is a great mistake, however, to suppose that an olive tree will produce profitable crops in a dry soil. Failure to give sufficient water and cultivation to both young and old trees is responsible for the lack of success in many thousands of acres of olives in California. Where the rainfall is very light, however, irrigation is necessary. It must not be excessive, and the water level must be kept low, otherwise the quality of the crop will be inferior and the trees more subject to disease.

Propagation.—Olives are generally propagated by cuttings. There are several different methods, but the following probably gives the best results: Young shoots, several inches long, are cut from strong, vigorous trees with a sharp knife. They should be cut as soon as their wood is fairly well hardened, but not too late in the season; and all the leaves should be removed, except two or three at the top. They should be planted immediately in shallow boxes of sand, placed in a greenhouse or a warm shady place and kept moderately moist. In three or four months most of them will be well rooted, and should be transplanted to pots or to a nursery where they will receive more sun. Here they should remain for three or four months longer, and are then ready to be planted in place. It is best not to plant them too early in the spring, before the soil has been well warmed; and care must be taken during the first year that they do not dry out.

An olive orchard may be brought into bearing a year earlier by using larger cuttings of old wood, but the trees are seldom so strong and are much more uneven than by the foregoing method. The cuttings or truncheons in this case are taken, in December or January, from branches two or three inches thick, and are cut about twenty to thirty inches long. They should be made only from strong healthy wood with sound bark. They should be cut so that they have knots at the base, as this favors the production of roots. Great care should be taken not to bruise them, and all the shoots should be removed except a few at the top. They should then be planted in a nursery of very light sandy soil, being buried about two thirds of their length and the soil tightly packed around them. The top ends of the cuttings should be coated with pitch, and, if the weather is hot or dry, the nursery should be shaded until the cuttings begin to throw out shoots. A very thorough watering should be given the ground immediately after planting, and the soil must never be allowed to get dry until the cuttings are well rooted. A certain portion of the cuttings will fail to grow with the best of care, and many will remain dormant for one or two years. Those which grow well, however, are ready for planting-out in the orchard the following season.

Another method commonly practiced is to cut sections of large branches one or two feet long, split them in two and then to bury the halves horizontally, with the bark up, about three inches deep in the nursery. If the soil of the nursery is warm, light, and well drained, and kept rather moist, a large number of shoots will in a few months start from the buried sections and come through the soil. When these shoots have become firm, but are still growing, they are cut off, with a sharp knife, as close as possible to the old wood and planted in the same manner as described above for the young shoots taken directly from the trees.

One of the commonest methods of propagation, used especially in Italy, is by means of "uovoli." This is the name given to the knot-like swellings that occur very plentifully on the trunk of many varieties, especially near the base, and on the exposed parts of the main roots. They are masses of dormant buds, and receive their name from their resemblance in shape, after removal, to eggs. They should be cut out carefully, and the places from which they are removed painted over with pitch. They are generally removed in November, and in frostless localities may be planted immediately. If necessary, they may be kept for three or four months in a dark cool place, buried in sand and planted in the nursery when danger of frost is past. The "uovoli" are planted three or four inches deep in a sandy soil, and of the many shoots which start from each, only the strongest is allowed to grow. They are ready to plant out in place in two or three years. This method of propagation, at one time common, is being gradually abandoned, as, besides injuring the trees from which the "uovoli" are taken, it results in poorly rooted, short-lived trees, which are inordinately prone to produce suckers.

The strongest, heaviest-bearing, and longest-lived trees are those grown from seed. Seedlings have a stronger and more deep-seated root-system, and grow into more regular and more hardy trees than those grown from cuttings. The only objection to their use is that they require several years longer time before commencing to bear. With care and intelligent cultivation, however, this delay can be reduced to one or two years, and the larger crops and healthier trees resulting, will more than compensate ultimately for the loss of time.

The flesh of the olive should be removed before planting the pits. This is commonly done by piling the fruit in heaps and allowing it to decay, after which the pits can be easily removed by washing. Many of the seeds of most varieties will not germinate. These are separated by placing all the pits in water and rejecting those which float. The pits may be planted immediately, or if there is danger of frost, kept in dry sand until spring. The pits must be cracked before sowing, or they will remain two years in the ground before germinating.. This must be done very carefully, in order not to injure the kernel; special instruments have been made for this purpose, which work well. Instead of cracking the pits they may be placed for twenty-four hours in a lye solution containing half a pound of caustic soda to one gallon of water. This softens the shell so that it soon decays in the soil and allows the young seedling to push through. The pits, after cracking or softening, should then be sown in a sandy bed heavily fertilized with thoroughly rotted manure. They are placed every three inches in little drills which are made six inches apart. Enough well-rotted manure should be placed in the drills to cover and surround the pits, and the whole covered with soil to the depth of one inch. The beds should be well watered until the seedlings start; after which less water should be used. When the seedlings have developed five or six leaves they should be transplanted to the nursery, the roots at the same time being cut back to about half their length. The olive, like all evergreen trees, is likely to suffer from transplanting, unless care is taken to remove the young plant with an adhering ball of earth. This is facilitated by the manure which is placed around the seed when planted.

The seedlings always revert more or less to the wild plant or type; so that it is necessary to graft or bud them with the variety which it is desired to propagate. This may, in very favorable cases, be done the spring after planting, but usually they are not large enough until after the second spring. Two-year-old wood should be used for grafting, and the grafts put in at the neck of the roots, just below the surface of the ground.

The ordinary wedge-graft is usually used, and the union should be carefully tied up and covered with grafting wax. The soil is then piled up around the graft until only two eyes are exposed. If the seedlings are large and have thick bark they may be budded in the stem just above the ground.

Transplanting, and Care of Young Trees.—It is customary in most olive-growing countries to keep the young trees in the nursery for several years—from four to twelve and even fourteen years, the average being about seven. This long sojourn in the nursery has two objects: First, as the olive can be transplanted at almost any age, the older trees run less risk of failing to grow than the very small ones if proper cultivation or irrigation should be neglected; and second, because when large trees are put out in the orchard they come into bearing several years earlier than when small ones are used, and so several years of cultivation of the orchard are saved. On the other hand, it should not be forgotten that the olive is no exception to the general rule that the younger a tree is when it is planted in its permanent place, the better and stronger will be the root-system which it develops, and consequently the more vigorous and long-lived the tree. Trees two or three years old can be planted out with perfect success, providing they are given careful cultivation for the first few years and watered and manured when necessary.

For the first four or five years, whether the young trees are planted out or left in the nursery, great care should be taken to prevent them growing into an undesirable shape. They should be well staked to keep them vertical, and the lateral shoots from the lower part of the stem should be removed when young, in order to avoid the necessity of making large wounds later. In cutting off these lateral shoots the cuts should not be made too close and the leaves at their bases should be left, as they help to feed the plant and protect the stem.

Pruning.—Though olive trees are grown in some districts without pruning, there can be no doubt that intelligent pruning increases the regularity, quantity, and quality of the crop. Heavy pruning at intervals of several years is practiced very commonly, but results in irregular bearing and renders the trees more susceptible to disease. The system which gives the best results from all points of view is a moderate pruning every year. Two main objects should be kept in view in pruning: 1. To give the tree the most convenient form; 2. To cause it to produce as large a crop each year as is consistent with the quality of the fruit and the health of the tree.

For the smallest-growing varieties the tree should branch out about three feet from the soil, and should be given a spherical, bush-like top. For the stronger and larger growers the trunk should be four or five feet high, and the branches should grow in "goblet" form. The object is to give every part of the tree, as nearly as possible, an equal amount of air and light, and to give it the form that best facilitates gathering the crop. It should always be kept in mind that any part that is unduly shaded will fail to produce fruit.

All the fruit of the olive is borne on two-year-old wood, and the same wood never bears twice. That is, the crop of this year is borne on the shoots that grew last year, and the next year's crop will be borne on the shoots that develop this year. For this reason a new crop of shoots each year is essential to regular bearing.

The art of pruning can be learned only by practice and experience; but it will be found useful to keep the following points in mind: Cut away all dead or diseased twigs or branches; thin out wherever the branches are too close; cut back the branches that tend to grow too long, in order to make them send out side shoots for fruiting wood. It should also be kept in mind that heavy pruning confines the sap to fewer outlets, and results in the production of vigorous sterile or wood-bearing shoots; while light pruning, leaving a larger number of buds, results in a large number of weaker and more fertile shoots. A tree, therefore, which has sent out an inordinate number of sterile shoots, should not be cut back much; while a tree that has been enfeebled by any cause must be more heavily pruned.

When a tree has been properly pruned from the beginning, it is seldom necessary to remove anything but small twigs, or to make large wounds. When, however, on account of improper pruning, or of great age of the tree, all the main branches of the tree have become bare, and all the fruit-bearing wood has disappeared from the center of the tree, it is necessary to cut back even the largest branches. This, however, should be done gradually, or the tree will be injured by a too sudden curtailment of the leaves, which are its feeding organs. A heavy pruning should be given the first year, sufficient to force out shoots from the lower parts of the branches. The next year the most vigorous and best situated of these shoots should be chosen to replace the old branches, and the latter cut back still further. A branch of any size should not be cut back too close to the old wood, even when it is intended to suppress it completely, as there is danger of injury to the main branches or trunk by drying out of the wood. Whenever a large cut is made, for any reason, it should be painted over with pitch, or some similar substance, to diminish evaporation and to prevent the growth of fungi.

Grafting and Budding.—It has already been stated that when an olive tree is raised from seed, it reverts more or less to the wild form, and produces fruit which is generally unsuited for either oil-making or pickling. To have the desired quality of fruit, therefore, it must be grafted or budded with a better variety. The method of doing this with young trees has already been described under the head of propagation. The olive may be grafted by almost any of the methods used for other fruit trees; but they are not to be recommended except when, as in the case of young seedlings, the graft can be made below the surface of the ground. For large trees, when it is desired to change the variety, budding is to be preferred.

Budding succeeds well if done at the right time and under the proper conditions. The essential points are that the bud must be taken from good healthy wood, and inserted in a vigorous shoot. Most of the failures in budding result from using a shoot of low vitality as a stock. In order to insure shoots of sufficient vigor to start a bud, the tree which is to be budded should be pruned severely the year before. If the tree is large it is advisable to cut back only half the branches the first year. The following spring the pruned branches will send out a number of vigorous shoots, the best of which may be budded. The following winter the rest of the branches should be cut back and the budding completed the second summer. In this way the tree does not receive so rude a shock as if all the branches were cut back the same year.

The ordinary T-bud succeeds very well on the olive, though some prefer the shield-bud. For the scion a dormant bud in the axil of a leaf may be taken, as is usually done for other plants. With the olive, however, twig-buds are more successful. The twig-bud is cut from the parent plant as shown in Fig. 1. It must be cut deeply with a sharp knife and part of the wood removed before insertion in the stock. Also about two thirds of each leaf on the twig-bud should be cut off to prevent drying out by too much evaporation. The bud is inserted in the usual way as shown in Fig. 2, and tied by winding a cotton string tightly around the stock, both above and below the bud, so as to cover up all the cut parts. Three or four weeks later the string should be removed and the stock topped. If the union has been effected the bud can be left to itself, simply cutting off the whole of the stock above the bud as soon as the latter has developed sufficient leaves.

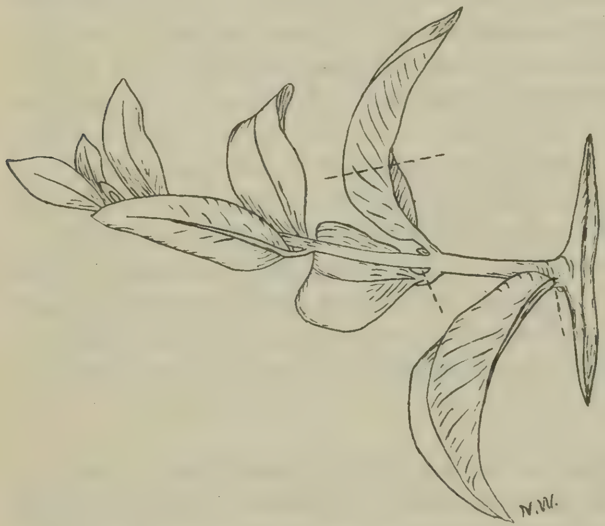

Fig. 1. Twig-Bud as Cut.

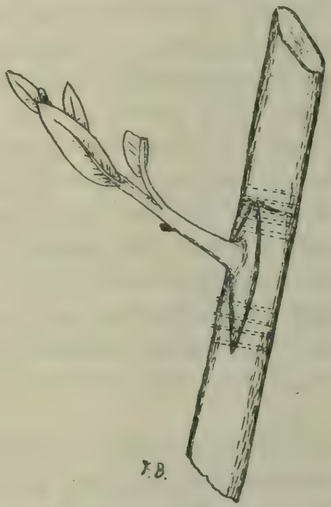

Fig. 2. Twig-Bud Inserted. (Dotted lines show manner of tying.)

Budding may be done at any time when the sap is flowing freely, but is most successful if done in the early summer or spring. If done too late the buds fail to start until the following spring, and are apt to dry out.

GATHERING THE FRUIT.

Picking Olives.—Whether olives are to be used for pickling or oil-making, it is very important that they should be picked carefully and at the right time. For green pickles they should be picked very soon after they obtain full size, but before they have begun to color or soften.

For ripe pickles they should be gathered at the same stage of ripeness as for oil-making; that is, when they contain the maximum amount of oil. This is soon after they are well colored, but before they have attained the deep black which signifies over-ripeness. If the olives are gathered too green the oil will be bitter; if too ripe, it will be rancid. On account of the different degrees of color in different varieties of olives, it is difficult to tell from their appearance when they should be gathered. When they can be easily shaken from the tree they are ripe enough. If they commence to fall without vigorous shaking they are over-ripe. For whatever purpose the olives are to be used they should be carefully gathered by hand. Rakes or sticks should never be used, as they bruise the fruit and break off a great deal of the fruit-shoots needed for the following year. It is well to sort the olives as they are being picked, separating out the bruised, diseased, or under-ripe fruit. When the olives are for oil-making they should be washed before being crushed or dried, unless they are very clean, for the road dust and sooty mold that often covers them have a deleterious effect on the quality of the oil.

OIL-MAKING.

Drying and Crushing.—The best oil is made by crushing the carefully-picked olives as soon as possible after they are taken from the tree, and while they are still perfectly fresh. If they are bruised, or if they are in the slightest degree moldy when crushed, the resulting oil will be correspondingly inferior in quality.

The extraction of oil from fresh olives is, however, somewhat troublesome, and in order to facilitate the work it is customary to deprive them of a certain part of their water before crushing. This partial drying is also useful when it is necessary to keep the fruit for some time before crushing or to ship them to any distance. It is generally done by placing them in layers not more than three inches deep, on trays that are stacked in a dry, well-aired room, protected from the wind and the direct rays of the sun. The olives are turned over daily until they become well wrinkled. This requires about eight or ten days, according to the degree of temperature. If the partially dried fruit can not then be crushed immediately, it must be stored in a dark room where the temperature does not rise above 60° F. Here it may remain three or four weeks longer without any serious deterioration of the quality of the oil. In order to hasten the drying process, artificial driers, constructed on the same principle as the fruit or hop driers, are sometimes used. The olives are placed in a single layer upon trays, and the drier is kept at a temperature of about 120° F. If the temperature rises over 130° F. the quality of the oil will be impaired. The drying takes about forty-eight hours—more or less—according to the nature of the fruit. The olives must be crushed immediately upon removal from the drier.

The problem of keeping olives until they can be crushed is an important one, as it is practically impossible to gather all the fruit of a large orchard just at the most favorable time and to crush it all while fresh. Numerous methods of solving this problem have been tried, but only three have been found which are free from serious objections. Drying at a low temperature, as already described, is that most generally used. They have been successfully preserved temporarily in water. The olives are placed in vats filled with fresh, pure water, which is changed at least daily, as is done in pickling. In mild climates not subject to heavy frosts, perhaps the best method is to leave the olives on the trees. The quality of the oil deteriorates slightly as the olives become over-ripe, but probably less than in drying. It is usually stated that the quantity of oil attains its maximum at the time the olives are ready for pickling, and that the apparent rise of oil content with further ripening is simply due to evaporation of water. Recent investigations, however, show that there is a real and even considerable increase of the amount of oil per tree until February or March. This adds another reason for leaving the olives on the trees until they can be worked, wherever the climate renders it possible.

The crushing is still commonly done by means of old-fashioned stone mills. They are slow, cumbersome, and irregular in their action. Moreover, almost all kinds of stone that are used for these mills absorb a certain amount of oil, which it is impossible to remove completely. This oil becomes rancid and taints the olives that are being crushed. Crushers, with corrugated bronze or bronzed metal rollers, are now made that perform their work in a very satisfactory manner, breaking up the flesh and pits very thoroughly. As they are all of metal they absorb no oil and are easily cleaned. It is very essential that the flesh should be crushed thoroughly in order to break up the cells and permit the oil to be pressed out.

Some oil-makers prefer to pit the olives before crushing, in order to separate the oil in the flesh from that in the pit. Machines for this purpose have been made, but are little used. The amount of oil contained in the pit is very slight, and is inferior in quality to that in the flesh, as it is much more prone to become rancid. Many varieties, notably the Mission, contain a particularly minute quantity of oil in the pits, and, as luckily a very small proportion even of this minute quantity can be expressed, there is little danger, usually, in crushing the pits and flesh together. No method, moreover, seems to have been devised as yet that will at one operation sufficiently crush the flesh while leaving the pit intact.

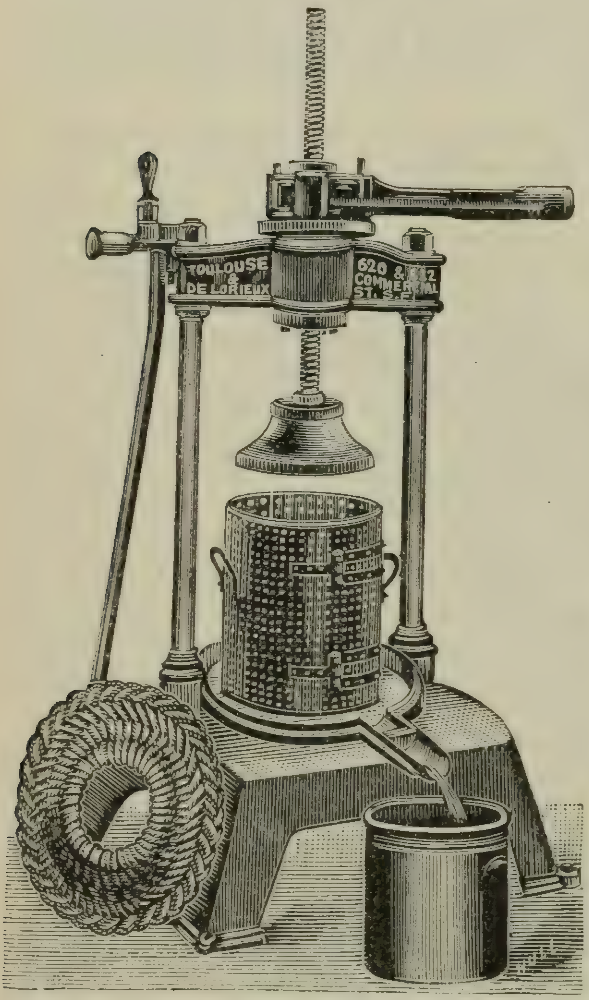

FIG. 3. OIL PRESS.

Pressing.—As soon as the olives have passed through the mill or crusher they should be pressed. For this purpose an extremely powerful screw or hydraulic press is necessary. Fig. 3 shows one that has been used with success at the Experiment Station. The mass of crushed olives should be placed in the press in such a manner that it will constitute a series of layers, each of which can drain off horizontally as the pressure is supplied. This is accomplished, among other ways, by means of wooden gratings and pieces of very strong cloth, or sacking, placed between the layers. Circular grass mats, used extensively in Europe, are very convenient, but as yet too expensive in California. The pressure must be applied very gradually. From the liquid which runs out first, with gentle pressure, is made the very finest oil, known as "virgin oil." The pressure is then increased very gradually until the full power of the machine is reached. This presses out the second quality of oil, which is generally mixed with the first. After obtaining all the oil possible by the first pressure, the "cheese" is taken out, thoroughly broken up in hot water, and again pressed. This yields the third quality, which is very much inferior to the first and second. Sometimes the "cheese" from the first pressing is thoroughly broken up with cold water and pressed again before being treated with hot water. In this way a little oil is obtained that differs little from the second quality, and may be mixed with it.

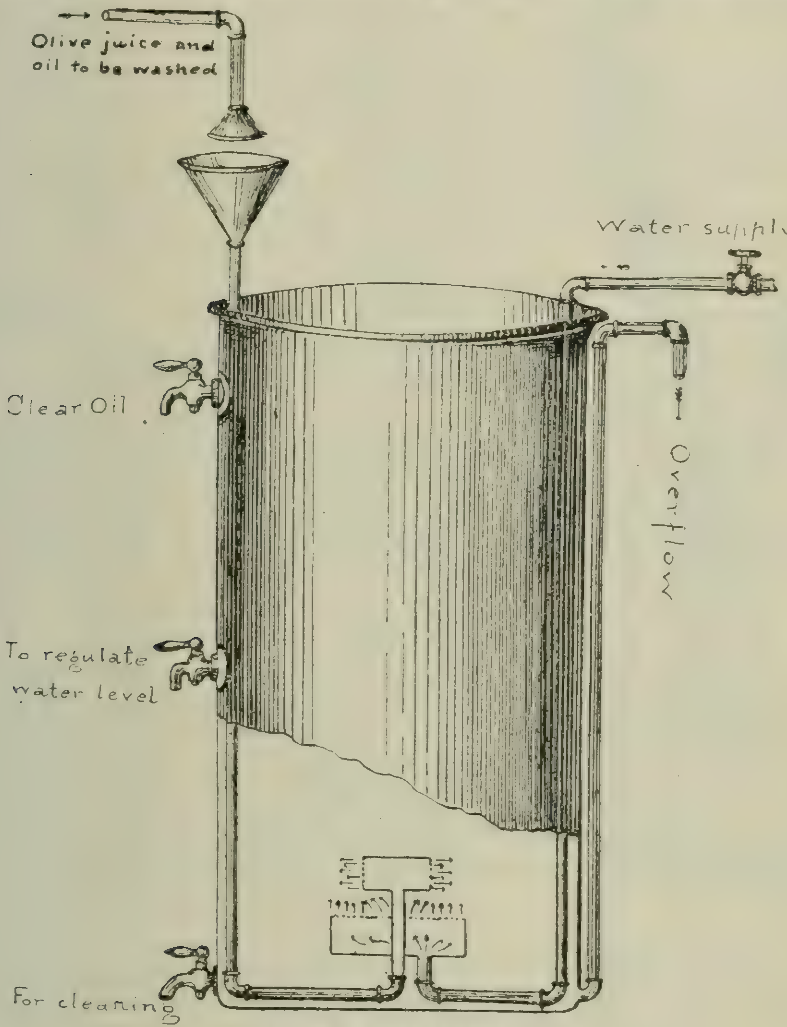

FIG. 4. OIL SEPARATOR.

After treatment with hot water, a certain amount of oil still remains in the "cheese," but it can be extracted only by very powerful hydraulic presses, or by chemical means, and is then of very inferior quality and suitable only for burning or for soap-making.

Separation of the Oil.—The liquid that runs from the press contains, besides the oil, the watery juices of the fruit and a considerable amount of pulpy solid matter. The separation of the oil is usually effected by allowing the press-liquid to settle in tinned vessels until the oil, rising to the top, can be skimmed off. The use of the apparatus shown in Fig. 4 is a great improvement over this method. It makes the separation of the oil almost instantaneous, and improves the quality by doing away with the prolonged contact of the oil with the air and the impurities of the liquid. The juices from the press flow into a tube, which opens into a small "drum" near the bottom of the tank which is kept constantly full of water. The drum is perforated at the sides in order to allow the press-liquid to escape horizontally. Immediately below this drum is another larger one, perforated on top, through which water is forced in vertical jets. The water and press-liquid are thus thoroughly mixed in constant agitation. This results in the rapid deposition of the heavy impurities, and the equally rapid rise of the small, light oil-drops. The oil very quickly forms a layer on top and can be drawn off by means of a faucet appropriately placed. The apparatus is continuous in its operation, and the oil is obtained free from all the grosser impurities. It is still, however, very cloudy, owing to the presence of small, light particles of vegetable matter.

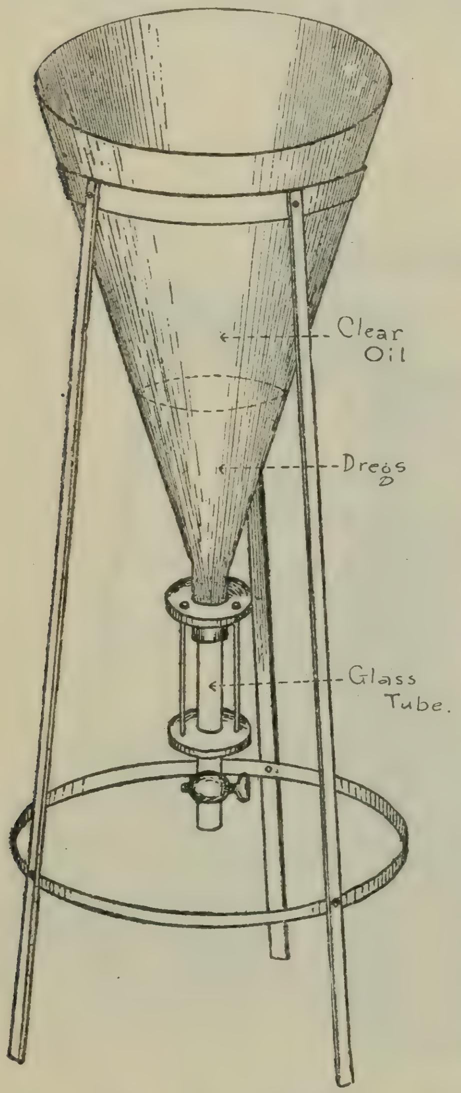

FIG. 5. OIL FUNNEL.

Clarification.—The oil must be made as bright as possible, before being put upon the market. This can be done by various methods of filtration. Filtration, however, diminishes the freshness and aroma of the oil and injures the qualities that distinguish a fine olive oil from the clear, neutral oils extracted from cotton-seed. This is especially true of such filtering media as charcoal, which exert some absorbent influence upon the oil, diminishing its flavor. The best method of clearing, for oil as for wine, is by simple settling and decantation. For this purpose a series of settling tanks is made use of. These may be made of well-tinned metal, or of cement lined with glass or other impervious substance. The first settling is conveniently made by means of a funnel-shaped apparatus such as that shown in Fig. 5. The steeply conical shape facilitates the rapid deposition of sediment. After standing for twenty-four hours in this apparatus the major part of the sediment is deposited and can be drawn off at the bottom. It is well, before running the oil into the settling tanks, to pass it through two or three inches of cotton wool. This is accomplished by means of a funnel with a perforated, horizontal cross-partition, upon which the cotton is placed. It takes, generally, about one month for the oil to settle sufficiently in the first tank, after which it should be drawn off carefully into the second, and so on until it is sufficiently bright. Three rackings are usually sufficient, and if all parts of the process have been well attended to, an oil is obtained almost as bright as can be produced by the most effective method of filtration, and having, besides, the agreeable and distinctive olive flavor and absence of greasiness which is lacking in all filtered oils.

Precautions.—The best oil can be made only from the cleanest and soundest olives. The most thorough cleanliness must be observed in all operations. Olive oil is particularly susceptible to bad odors, and the presence of a smoky lamp or stove, or of tobacco smoke, will certainly communicate a corresponding taste to the oil. Air and light must be excluded from it as much as possible, as they favor the oxidation which is the cause of rancidity. Contact with wood, cloth, or any materials of an absorbent nature should be avoided as much as possible, as it is extremely difficult to free them from the oil which they absorb. This finally becomes rancid, and the taint is communicated to the good oil. For the same reason no oil should be allowed to remain on any part of the work room, and the free use of boiling water and soda, whenever oil is spilled, is essential. Iron has an injurious effect, especially on the unclarified oil, and all iron utensils should be well tinned. It is also very necessary to preserve an even and proper temperature in the press and storage rooms. If the temperature is too low the oil becomes too thick, and at very low temperatures it solidifies; this makes it impossible to handle or clear it. If the temperature is too high, oxidation is facilitated. The temperature should, therefore, not be allowed to fall below 50° F. nor to rise above 65° F., and should be kept as even as possible. The water used must be free from all taint.

PICKLING.

The successful production of pickled olives is a matter of experience and depends almost altogether on the individual judgment and skill of the producer. No method can be given which is suitable to all cases, and the best method must be modified according to the nature of the olives to be treated. The following scheme, therefore, is to be considered as a mere outline, to be carefully adapted and modified by the operator at each stage of the process:

Lye Process.—1. Place the olives in a solution, composed of two ounces of potash lye to one gallon of water, for four hours. Repeat this once, or twice *if necessary*, to sufficiently remove the tartness.

2.* Rinse the olives thoroughly and replace the lye solution with fresh water. Change the water twice a day, until the potash has been removed from the olive, as judged by the taste.

3. Replace the water with brine composed of four ounces of salt to a gallon of water and allowed to stand two days.

4. Put in brine of six ounces of salt to a gallon for seven days.

5. Put in brine of ten ounces per gallon for two weeks.

6. Put finally into a brine containing fourteen ounces of salt to the gallon of water.

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* Professor Hilgard recommends the use of weak brine from the first, that is, as soon as the lye solution is removed.

In order to make this process a success the following considerations should be kept in view:

1. Great care should be taken not to allow the olives to come in contact with anything that will injure their flavor. The vats or other receptacles used for pickling should be perfectly clean, odorless, and tasteless. Earthenware is the best material, but it is usually cheaper and more convenient to use wooden receptacles thoroughly treated with boiling water and soda until they are sterilized and all taste of the wood removed. Any wood (such as pine) with strong taste should not be used. The vats should be provided with a removable wooden grating, fastened one or two inches from the bottom, and a close fitting floating wooden cover to prevent access of air, which spots the fruit. On top of the vats should be placed a cover of thick cloth or of wood to exclude light and dust. Each vat should be provided at the bottom with a wooden spigot for drawing off the solutions.

The thickness of the layer of olives should not be more than two feet, or less with soft varieties.

2. Only the very best of potash lye should be used. Some of the brands of lye are so impure that it is impossible, without a chemical analysis, to tell within forty per cent how strong the lye solution actually is when made up. "Greenbank lye" has been found the most reliable, and may be considered as one hundred per cent pure when making up the solution. The length of time which the olives should be left in the lye, and the number of times the lye should be renewed, can only be determined by experiment for each variety and each locality. The object is to extract the tartness of the olive, and at the same time to soften the skin sufficiently to allow the tart or bitter substances to be soaked out in the subsequent treatment with pure water. The tougher and thicker the skin of the olive and the more intense the tartness, the longer must the lye treatment be continued. The lye is sometimes made twice as strong as recommended above, and the treatment correspondingly shorter, but the results are not so good. Just enough lye solution should be used to exactly cover the olives, and occasionally, during the soaking, some of the solution should be drawn off below and poured on top to insure an equal treatment of all the fruit.

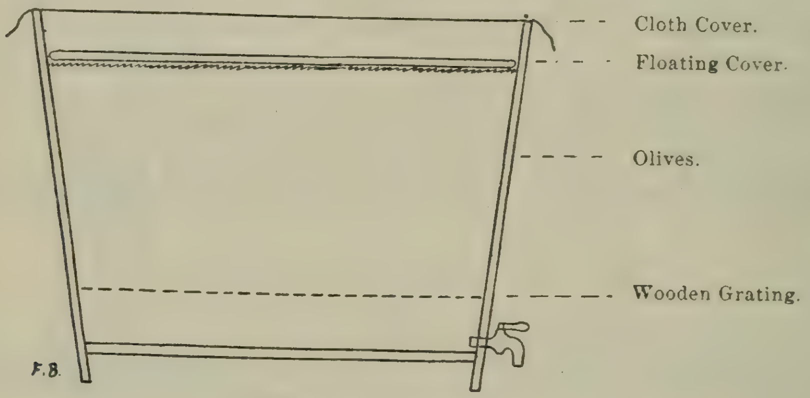

FIG. 6. PICKLING VAT.

3. Only the very purest water should be used, both for the lye solution and for the subsequent soaking. Canal and river water, or any water that contains a great deal of organic matter, should never be used unless

it is practicable to boil it first. Distilled water, such as can sometimes be obtained by condensing the waste steam from a boiler, is the best, both on account of its purity and its greater extractive power, provided of course it be free from oily flavors. The length of time during which the soaking in pure water should be continued, varies very much in accordance with the character of the fruit. If the olives are firm and show no signs of becoming soft it should continue until the tartness is sufficiently extracted. This will vary usually between ten and twenty days. The moment that the olives begin to show signs of softening, however, they should be placed in weak brine, even though the tartness has not all disappeared. What remains can then be extracted by the brine, which should be changed two or three times as may be necessary. It is not necessary to change the brine quite so often as the pure water, once in two days being generally sufficient.

If the olives are soft at first, before treatment with lye, or if they are of a kind that softens rapidly in the lye, it is necessary to use brine from the beginning, either immediately after treatment with lye or, in extreme cases, with the lye. This method, suggested by Professor Hilgard, has been used with marked success. The lye solution in this case should be made by adding two ounces (or less, if the olives are not very bitter) of lye and four ounces of salt to each gallon of water. As the lye acts much more slowly when used in combination with salt, it may be allowed to stay on the olives for a longer time without injury—eight to twelve hours, or even more. In this way the lye solution tends to soften and swell the olives; the brine counteracts this, and tends to harden and shrink them. The shrinkage, which occurs when brine is used from the beginning on naturally soft olives, is not a disadvantage if not carried too far, as such olives are generally too watery to be palatable or to keep well. They can, moreover, if shrunk too much, be made plump again by a few treatments with pure water before being put finally into brine.

The first salting must be done very gradually and carefully in order to prevent shrinkage and wrinkling of the fruit. For this reason, gradually increasing strengths of brine must be used, as described, and the olives left long enough in each to be thoroughly penetrated.

In all these operations no sign of scum or slime should be allowed to accumulate on the olives, the vats or the covers. This is of especial importance during the treatment with plain water. On the first signs of sliminess around the sides of the vats, where it appears first, the latter should be emptied and thoroughly brushed and scalded before replacing the olives.

Pure-Water Process.—The best pickled olives are made without the use of lye, but this process is only practicable with olives whose tartness is easily extracted, and where the water is extremely pure and plentiful, and even then it is very slow and tedious. It differs from the last process only in omitting the preliminary lye treatment. The olives are placed from the beginning in pure water, which is changed twice a day until the bitterness is sufficiently extracted. This requires from forty to sixty days or more. The extraction is sometimes hastened by making two or three shallow, longitudinal slits in each olive, but this modification, besides requiring a large amount of expensive handling, renders the fruit peculiarly susceptible to bacterial decay and softening.

Green Pickles.—Green pickled olives are made by essentially the same processes as are used for ripe pickles. The extraction of the tartness requires the same care and the same close adaptation to peculiarities of different varieties as already described. The olives are pickled soon after they have attained full size, and before they have shown any signs of coloring or softening. They contain at this time comparatively little oil, and are in every way much inferior to the ripe pickles in nutritive value. They are not a food, but a relish. They are rather more easily made than the ripe pickles, as there is less danger of spoiling. There is, however, very little market for any but the largest sizes.

Nutritive Value of Olives.—Pickled *ripe olives* constitute an extremely nutritious and digestible form of food. They contain a large amount of oil, carbohydrates, and some nitrogenous matter, and in some countries replace meat to a certain extent. Pickled *green olives*, such as those imported from Spain, are, on the contrary, indigestible and contain much less nutriment. They are made from unripe fruit and are therefore, as far as their use as food is concerned, in no way superior to unripe apples or peaches. They are simply a relish and to be used in very limited quantities, in the same way as pickled walnuts or cucumbers. A meal of bread and ripe olives is not only palatable but nutritious and sustaining, and the amount eaten is to be limited only by the same considerations as that of any other good, wholesome food.

The following table of analyses, prepared by Professor Jaffa of this Station, illustrates very forcibly the superiority of ripe pickles over green ones in nutritive value:

ANALYSES OF EDIBLE PART OF RIPE AND OF GREEN PICKLES.

	RIPE PICKLED OLIVES FROM CALIFORNIA.			Queen Olives (green) From Spain.
	Medium-sized Mission.		Larger, Watery Mission.	
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Water	64.72	65.45	72.77	78 41
Oil	25.89	25.15	18.81	12.90
Carbohydrates	4.28	3.22	2.49	1.78
Other matters	5.11	6.18	5.93	6.91

The Queen olives were the best of their kind to be found on the market, and when compared with the first two samples of ripe pickles, which are typical of good ripe Missions, show just half the amount of nutritive material. This does not show the whole difference, for there is no doubt that the nutriment in the ripe fruit is in a much more readily assimilable form than in the green. The third sample was grown on an over-irrigated soil, and while inferior to the first two, is much superior to the green fruit both in quantity and quality of nutriment.

Grading and Sorting.—It is extremely important that all the olives in each lot of pickles should be as nearly as possible uniform in character, in order to facilitate the process of pickling and to produce an attractive appearance. Olives of different varieties, and even those of the same variety from dissimilar locations, should never be mixed.

The first sorting is done while gathering, and the under-ripe, over-ripe, and injured fruit separated from that which is to be pickled. The good fruit is then graded by means of a mechanical grader according to size. In this way the olives are separated into different lots which will each contain fruit on which the different processes of pickling will act uniformly. A grader adapted to handling soft fruit, that will not bruise the olives, must be used. That represented by Fig. 7 has been used successfully. After the pickling process is finished there will often be a distinct difference of color between different olives of the same lot. Another sorting according to color is then advisable. This must be done by hand, and either two or three colors may be separated, dark and light or black, medium, and greenish according to the variety.

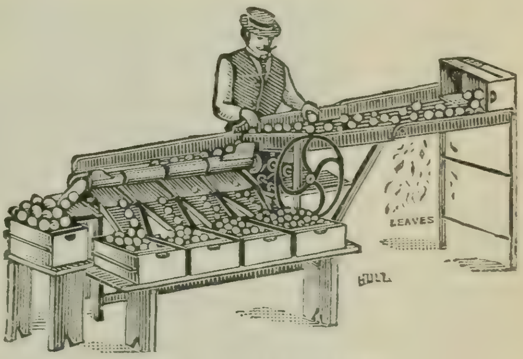

FIG. 7. OLIVE GRADER.

SUMMARY OF THE RESULTS OF VARIOUS METHODS OF KEEPING THE PICKLED OLIVES.*

1. Seven samples (Gordal, Picholine, Regalis, Manzanillo, Mission, Columbella, and Rouget) were placed in 12 per cent brine in open earthenware jars with floating wooden covers. A little mold formed around the edge of the floating cover, but the pickles were uninjured in flavor, texture, or color, at the end of eight months.

2. Four samples (Gordal, Regalis, Columbella, and Sevillano) were placed in 12 per cent brine in hermetically sealed fruit-preserving jars immediately after pickling. All except the Regalis were very moldy at the end of eleven months, and they were all quite spoiled at the end of thirty-two months.

3. Seven samples (Gordal, Picholine, Regalis, Manzanillo, Mission, Columbella, and Rouget) were kept in open jars for eight months (see No. 1) and then placed in fresh 12 per cent brine in sealed fruit-preserving jars. When examined at the end of eleven months (three months after sealing) they were all sound, but at the end of thirty-two months the Manzanillo was almost spoiled, the Gordal much deteriorated, and the others though still edible were much injured in flavor and appearance.

4. Three samples (Gordal, Regalis, and Columbella) were placed in 12 per cent brine in sealed fruit-preserving jars and heated to 80° C. (176° F.) immediately after pickling. They were all in perfect condition when examined at the end of thirty-two months. A sample of Sevillano, which was treated in the same way except that it was heated to only 70° C. (158° F.), had deteriorated slightly, but was still quite edible, while a corresponding unheated sample was quite spoiled.

5. Seven samples of the pickles kept in open jars for eight months (see No. 1) were placed in sealed fruit-preserving jars at the end of the eight months and heated to 80° C. (176° F.). All the samples kept

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*Extract from Bulletin No. 137.

perfectly with the exception of the Manzanillo, which showed a slight deterioration in flavor.

6. Three samples (Gordal, Picholine, and Regalis) of the pickles kept in open jars (see No. 1) were placed in pure water in sealed fruit-preserving jars at the end of the eight months and heated to 80° C. (176° F.). All kept perfectly and were preferable to all the others at the end of thirty-two months, on account of the smaller amount of salt that they contained. The specific gravity of the brine at the end of the thirty-two months indicated only 5 per cent salt.

7. Three samples (Gordal, Regalis, and Columbella) were heated to 80° C. (176° F.) three times on successive days in sealed fruit-preserving jars and kept perfectly, but showed no superiority to those heated only once. One sample (Sevillano) heated in the same way three times to 70° C. (158° F.) also kept perfectly, and was superior at the end of thirty-two months to a sample of the same variety heated only once to 70° C. (158° F.).

8. Three samples (Manzanillo, Columbella, and Rouget) were placed in sealed fruit-preserving jars and covered with a layer of paraffin before being heated to 80° C. (176° F.). They all kept perfectly, but the paraffin was objectionable, and though the Manzanillo sample seemed to have kept a little better than the heated sample without paraffin, a little longer or higher heating would doubtless be equally effective, and the troublesome and unsightly paraffin would not be needed.

In a general way it may be said that all of the eleven *unheated* samples kept in fair to good condition for eleven months, but that they were all more or less spoiled before the end of thirty-two months; and on the other hand, that all the twenty samples *heated to 80° C.*(176° F.) kept perfectly to the end of thirty-two months, and were quite as good if not better than when first made, with the exception of one sample, which had deteriorated slightly.

It may be concluded from this that heating to 80° C. (176°F.) is a sufficient means of preserving ripe olives, even in weak brine, for an indefinite period in hermetically sealed glass jars, provided that they are exposed to no greater changes of temperature than occur in an ordinary room in Berkeley. Whether they would have kept so long without deterioration if exposed to the trying conditions of shipment to Eastern points is doubtful; but there is no doubt that they would have kept much better and longer, even under those conditions, than olives treated in the usual way, and there is every reason to believe that a slightly higher heating, say to 90° or 95° C. (194° or 203° F.), would have made them perfectly secure in any climate.

That this heating could be applied successfully to *olives in wooden casks* seems highly probable. A method which would doubtless be effective would be to place the pickles in an 8 or 10 per cent brine in casks previously sterilized by steaming, and then to heat them with a current of pressure steam conducted directly into the brine. It would not be difficult to devise means for preventing the superheated steam from coming directly in contact with the olives and to keep them in constant movement in order to guard against too much heating of a part of the contents of the cask until they were all heated to a uniform temperature of 90° C. (140° F.). Properly picked olives are, moreover, very resistant to heat, and even 100° C. (212° F.) continued for half an hour has no perceptible effect on their texture or flavor, unless it be a slight improvement of both.

The only objection to heating noted was that it causes a diffusion of the coloring matter of the olives into the brine, so that after heating the olives were lighter-colored and the brine darker than before. This diffusion, however, takes place in time even with unheated olives, and at the end of thirty-two months the unheated olives were in most cases actually lighter-colored than those which had been heated.

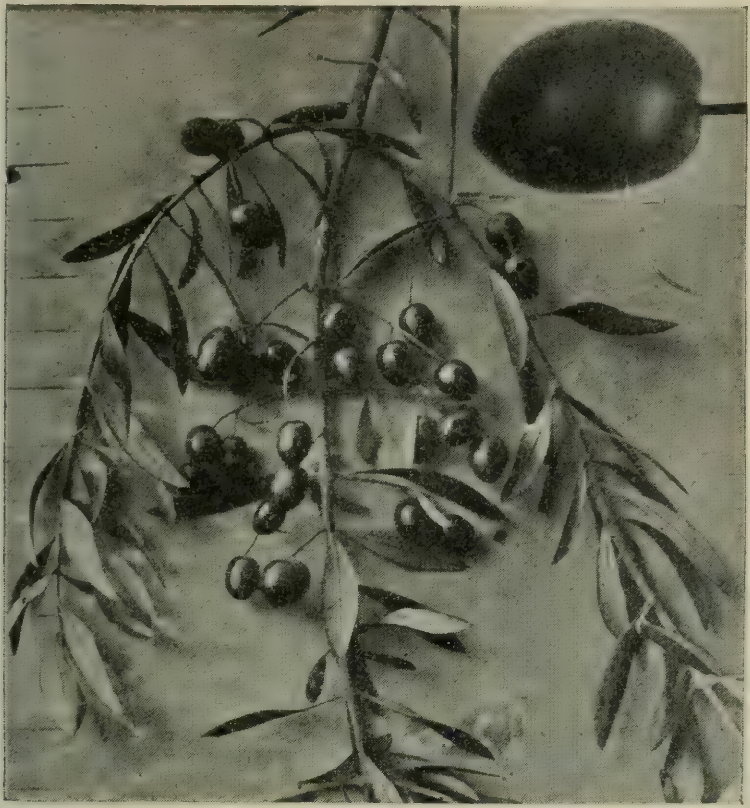

FIG. 8. MISSION OLIVE OF CALIFORNIA. (Single Olive Natural Size.)

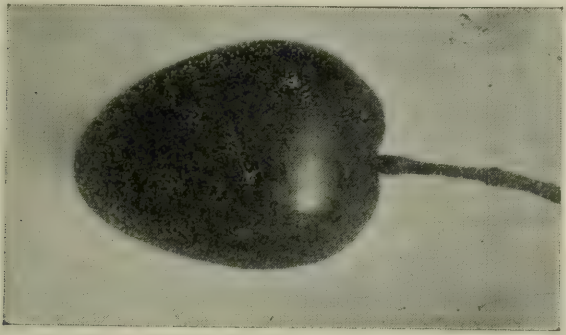

FIG. 9. SEVILLANO OLIVE. (Natural Size.)

EXPERIMENTS IN PICKLING GREEN OLIVES.—A series of experiments made at this Station shows that it is possible to produce green pickled olives which will retain their color for at least twelve months by the lye-and-salt method of treatment, if properly modified and controlled. The color is preserved, so that exposure to the air *after* the completion of the pickling process does not seriously affect the color for some time. The following process, based upon these experiments, is recommended:

Choice of Fruit.—Only large-fruited varieties should be used, as the small green pickles bring a very inferior price. The olives should be gathered as soon as they have reached full size and before they have colored noticeably. A slight pink color on one side does little harm, as it disappears during the process, but olives which have reached the stage of ripeness indicated by this first change of color will probably have less of the bright green than if gathered earlier. No two varieties should be pickled together, and the olives should be graded into three or four sizes. The reason for this is that different varieties and different sizes are almost sure to require different strengths of lye-solution, and it is therefore impossible to attain the best results unless this selection is made. The proper strength of lye solution to use in each case is best determined by a preliminary trial, as follows:

Preliminary Trial.—Take a series—about six—of pint preserving-jars and fill them with the olives to be tested. Pour into them, respectively, a ½, 1, 1½, 2, 2½, and 3 per cent lye-solution, sufficient to completely cover the fruit. At the end of forty-eight hours examine them. (It has been found that a sufficiently strong lye-solution will extract the acid and bitter principles of even very bitter olives in forty-eight hours.) At the end of this time some of the weaker lye-solutions will be found to have been neutralized, that is to say all the lye will have been used up in acting upon the acids of the fruit. This will be made evident by the lack of the slimy feeling which the fingers have when dipped into a lye-solution and rubbed together. Suppose that the ½, 1, and 1½ per cent solutions are neutralized, and that the 2 per cent still has a slight slimy feeling. This will show that a 2 per cent solution is a little stronger than is necessary to neutralize all the bitter or acrid matters in the sample tested. If, now, we use a 2 per cent solution in curing the bulk of the olives from which the sample was taken, we are able to preserve the green color perfectly. If we use a somewhat stronger solution, say a 2½ per cent, the color will bleach out a little; while if we use a much weaker solution, say a 1 per cent, the green will change to that disagreeable gray or brown which we wish to avoid.

Process.—The appropriate strength of lye-solution having been determined, the olives are placed in convenient receptacles, where they can be treated with a minimum exposure to light and air. For this purpose fifty-gallon barrels with very large bungholes (four or five inches in diameter) and spigots are useful. After filling the barrels with olives the lye of the strength determined in the preliminary trial is poured in. Each barrel should be quite full of olives, and sufficient lye-solution should be put in to come flush with the bunghole. At the end of forty-eight hours the lye should be drawn off, the olives quickly washed with two changes of fresh water, and the barrels filled immediately with a 2 per cent salt-solution. This brine should be replaced successively with a 4 and 8 per cent, and finally a 12 per cent solution, in the last of which the pickles remain permanently. The successive brines should be allowed to act for from forty-eight to seventy-two hours each, according to the size of the olives; the larger sizes requiring more time for the brine to penetrate and to displace the excess of lye which remains. The whole process will thus take from ten to fourteen days.

Absence of Air.—The essential part of the process is to avoid exposing the olives to the air during the pickling, until all the bitterness and acid are completely neutralized by the lye. After this the green color seems to be fixed, and exposure to the air does not change it much, though it is well, all through the process, to avoid leaving the olives uncovered by the liquid any longer than necessary.

As different varieties of olives and even the same variety in different seasons and from different localities differ very much in bitterness, the importance of treating each variety separately is evident, as each will require lye-solutions of different strength to neutralize them. Very bitter olives, such as Mission, Sevillano, Manzanillo, and True Picholine, require solutions containing from 1½ to 2½ per cent of pure potash lye, while olives containing little bitterness, such as Ascolano and Columbella, require only from ½ to 1 per cent solutions. As many of the commercial lyes are far from pure, some containing not more than 50 per cent of potash, the number of preliminary tests must usually be at least six, as indicated above. Preliminary tests, conducted as described, do not require an analysis of the lye, though it is probable that lyes containing a large amount of common salt would act more slowly; and with such lyes a treatment exceeding forty-eight hours might be necessary.

To facilitate the preparation of the different strengths of solutions, it is convenient to remember that as a gallon of water weighs 128 ounces, one and a quarter ounce of solid lye is equal (in round numbers) to 1 per cent; or that one pound of such lye will make nearly twelve and a half gallons of 1 per cent solution.

Note by E. W. Hilgard.—To the above recommendations on the subject of pickling I would add from my personal experience the following points:

1. The stronger the lye used in extracting the tartness of the olive, the more the flesh is softened and the more difficult it will be to make the pickle keep. Moreover, the stronger the lye, and therefore the shorter the time of extraction, the greater the liability to its being overdone, or underdone. It is far better, by repeatedly using a weak lye, say not exceeding two ounces per gallon, to prolong the time of extraction and thus be able to gauge exactly and leisurely the right amount for stopping the process. I should never expect any fruit extracted within four or five hours to keep beyond six months. As many days will be found a wiser economy in the end, the weak lye being renewed as often as may be found necessary by its becoming saturated with the "tartness." This is easily determined by its ceasing to feel "soapy" between the fingers.

2. The use of salt brine is advisable at any time when the fruit appears to be softening too much, which may readily happen, especially in the case of that which has been grown on low or over-irrigated ground, where it becomes pulpy and large. Such fruit can be firmed

and properly reduced in size, and made to keep, by the timely use of brine of properly graduated strength. This use need not be deferred until after the lye has been washed out; the salt in nowise interferes with its action. I consider close attention to this point of extreme importance in respect to the keeping qualities of ripe-pickled olives; and it is readily seen that here again, the use of good judgment and close observation is of the utmost importance, and that no routine prescription will answer.

3. Different varieties of olives must never be treated together. When one is done just right, another will be found over or under done. The same consideration applies to fruit of greatly different sizes. No uniformity of texture, flavor, or color can be expected when different varieties and sizes are pickled together.

DISEASES.

Both the olive tree and its fruit are subject to a large number of diseases in Europe. Luckily most of these, and some of the most destructive, have not yet appeared in California. In this report only those which have assumed some importance in the State are described.

Twig Borer.—The small black or brown insect which bores into the small branches of the olive at the base of a bud or twig is a beetle called *Polycaon confertus.* No method of extermination has been devised, but luckily it seldom does any great damage. As the twigs which are attacked are weakened, they should be removed at time of pruning and burned. This will prevent the waste of nourishment on weakened twigs, and destroy any borers that remain in the holes.

Black Scale.—Although other varieties of scale insects are occasionally found upon the olive, the black scale is the only one that does serious damage, and is, in fact, the worst enemy of the olive tree in California. The injury done by the insect is due to the extraction of nourishment and water, and when the insects are plentiful, to the "hide-bound" condition of the tree that ensues, preventing the proper growth and assimilation of food materials. A secondary injury is due to the growth of fungi, induced by the presence of the scale. This will be discussed later under *Sooty Mold.* The black scale is most prevalent in the orchards near the coast. The extremely dry air, which occurs occasionally for long periods in the interior valleys, usually prevents it reaching injurious numbers. The black scale has many natural insect enemies, but none of them are capable of repressing it sufficiently when other conditions are favorable to its growth and multiplication.

The small Australian lady-bird (*Rhizobius ventralis*) feeds upon this scale, and was at one time looked upon as a certain remedy where-ever it found the proper conditions for its growth and multiplication, *i. e.*, near the coast. At present there is great doubt whether the diminution of black scale, that seems to have occurred where the *Rhizobius* was first introduced, is really all to be credited to this insect. The black scale is subject to certain fungous and bacterial diseases, which, under favorable conditions, and especially when the insects have become very abundant, often destroy all of the scale present. In this way orchards that have been thoroughly infested by black scale for several years, will become almost entirely free from them for a long time without any treatment at all. The most effective method of combating this scale is certainly the hydrocyanic acid gas treatment, but it is too expensive. The only remedy that at present seems to be reasonably certain, effective, and economical, is intelligently conducted spraying. The best and cheapest spray for this purpose is a resin-soap wash made of the following ingredients: Resin, 8 pounds; standard caustic soda, 2 pounds; fish oil, 1 pint; water, 40 gallons.

The resin, soda, and fish oil are placed in a closed kettle with just enough water to cover them, and boiled for two hours. This will form a soap which is to be diluted with hot water, in the proportion mentioned, before use. It is best applied warm. Kerosene emulsion is also effective and convenient, but somewhat more expensive.

A regular annual spraying at a stated time is not to be recommended, and is not effective. For the best results the insects must be watched, and whenever the very young insects appear in large numbers on the leaves and stems, the spray should be applied. This is because the young insects are very much easier to kill than those which are mature and possess a hard protecting shell. In some years two or even three sprayings may be necessary, while for other years spraying may be omitted altogether.

Sooty Mold.—The black scale excretes a sticky substance that is excellent food for various kinds of fungi, and particularly for that known as Sooty Mold. This fungus appears as a black coating on the leaves, stems, and fruit. It does not penetrate the tissues of the plant, and therefore does not injure them directly like some fungi. By shutting off the light, however, it interferes with the assimilation of food by the leaves, which takes place only in the presence of full light. Some injury is also done to the appearance of the fruit by the coating of black fungus, and the dirt and fungi adhering to the sticky substance on the olives no doubt have a deleterious effect on the quality of the oil. As the sooty mold grows only upon the excretions of the black scale and not upon the substance of the plant, the repression of the scale will result in the disappearance of the mold.

Peacock Leaf Spot.—This disease is caused by a fungus called *Cycloconium oleaginum*, which grows upon the leaves and fruit. It forms spots about one eighth of an inch in diameter on the leaves, composed of concentric rings of different shades, which give them an appearance resembling the spots on a peacock's tail. On the fruit the spots are smaller and browner. This disease is very prevalent at Berkeley, and has been found in other localities. It usually does little harm, and can be controlled by the Bordeaux mixture. It occasionally becomes sufficiently abundant to make the leaves turn yellowish, and injures the appearance of the fruit a little for pickling.

Dry Rot.—Ripe olives are sometimes attacked by a disease which appears as a shriveling and drying-up of one part, generally the apex, but occasionally the stem end. The disease progresses, especially in warm weather, until a large part of the tissue of the olive is destroyed. After the olives are picked and placed in boxes or on trays, especially the former, the disease progresses more rapidly on account of the greater heat and moisture generally present. The Nevadillo seems particularly susceptible to this disease. Keeping the trees clean and well aërated, and in general the means suggested for the Sooty Mold, are the most likely remedies to be used for dry rot. The disease is casued by two species of fungus, an *Alternaria* and a *Macrosporium;* the former is most usually found.

Bacterial Rot.—Certain large, fleshy olives are subject to a disease which attacks the flesh in the immediate vicinity of the pit. Olives attacked by this disease appear at first perfectly healthy, but if they are cut open it will be found that there are black spots in the flesh near the pit. These spots gradually spread until they surround the pit completely, and in the advanced stage of the disease the olive is almost hollow. It is only at this stage that it is possible to tell from the outside that the olive is not sound. Large numbers of bacteria can be found in the decayed tissue, and it is to them that the disease is due, in all probability. The varieties most subject to this disease are the Polymorpha, Macrocarpa, Columbella, and Obliza.

Another disease somewhat resembling this in character and probably in origin, often attacks soft, fleshy olives. It appears first as small depressions on the outside of the fruit resembling the results of bruising. These depressions enlarge in size and finally involve a large part of the fruit. If cut open it will be found that the tissue below the depressions is brown and decayed, but not hollowed out as is the case with the decay last described. Olives attacked by either of these diseases will, of course, give an inferior oil, and are very difficult to pickle. They should be used for pickling as soon as possible after the disease is discovered, and treated by Professor Hilgard's method of combined lye and salt solution. The Manzanillo seems to be particularly susceptible to this disease. As both of these diseases attack principally large, fleshy varieties, and especially very juicy fruit, it is very likely that the methods, especially drainage, recommended for Olive Knot, would be effective in restraining its development.

Olive Knot.—This disease appears as woody tumors on the leaves, branches, stems, and particularly on the small twigs of olive trees of all ages. It is confined to warm localities and especially to rich, overmoist soils. The size of the tumors on the leaves varies from that of a pinhead to that of a pea. On the twigs they are usually about the size of a hazel-nut or walnut. On the main stem they may be large, and they sometimes, especially in the neighborhood of cuts or plow wounds, run together and form large masses of dry, fissured, tumor-like tissue. The disease is rather slow in its progress, and for one or two years seems to do little damage to the trees. Trees when first attacked may even bear more heavily than usual. Finally, however, at the end of four or five years, the amount of food material taken up by the knots is so large that the tree suffers from starvation and finally becomes useless. The disease is caused by a certain species of bacterium which commences to grow just under the bark, and lives in the interior of the tumor it produces. It is carried from tree to tree by pruning instruments, also probably by insects which puncture the bark, and perhaps by the wind. It only attacks trees which are vigorous and full of sap. The varieties which are most valuable for their fruit, that is, those most removed from the wild type, are the most subject to attack.

As the disease can not occur without infection from the special bacterium which causes it, the greatest care should be taken to destroy the bacteria and prevent their being taken from one tree to another. Upon the first appearance of the knots, the twigs on which they appear should be cut off and burnt on the spot; and unless the orchard is naturally well isolated from all others, the whole tree should be destroyed in the same way. No tools used upon an affected tree should be used upon any other until they have been thoroughly disinfected with boiling water. Heavy pruning should be avoided, as it tends to produce a growth of sappy shoots particularly liable to infection. Finally, underdrainage, whenever practicable, is the most effective method of prevention.

ANIMAL INDUSTRY AND DAIRY HUSBANDRY.

By Leroy Anderson.

The work of this department has been along lines of instruction rather than experimentation. The larger portion of the first year (1900–1901) was spent in traveling about the State attending Farmers' Institutes and making some study of the conditions of the dairy industry. There is room for much improvement in the dairy herds, particularly along the lines of breeding and of feeding. The Experiment Station should be equipped with a herd of cattle, as well as other livestock, to afford means of experimentation and example along both these lines. And probably as much lasting good could be done by coöperative feeding experiments with farmers in different sections of the State. There should be both means and time allowed for this work. Concerning dairy manufacture, the problems of making an improved quality of butter and of making a clean flavored butter which will stand storage and shipment are of prime importance to the industry. These offer a large and attractive field for experiment and should be generously provided for. Some of the lines of activity of this department are here given in detail.

FEEDING SUGAR-BEET PULP.

(Taken from Bulletin No. 132.)

We have no detailed experiment to report for this State concerning the value of beet pulp as a stock food, nor showing how it should best be fed. We have, however, the record of milk production from a small herd of cows which were fed beet pulp for about ten weeks. And through the kindness of several of the leading stockmen of the State we have secured their experience in feeding it and are able to present it here. It is interesting to note that the results obtained from feeding the pulp in this State agree with European experience.

The herd of cows mentioned above was owned in Berkeley by Mr. W. B. Barber, who kept the milk record and weighed the beet pulp which each cow consumed. The cows were mostly Shorthorn foundation, with some infusion of Jersey blood. All but "Jersey" dropped their calves in July, 1900, and she dropped hers in April. Owing to various circumstances, it was not possible to keep an accurate record of the weight of hay consumed, and thus the amount required by each cow can be given only approximately. When no beet pulp was fed, the cows ate an average of about 20 pounds of hay per head daily in addition to 8 pounds of grain. When eating beet pulp the daily consumption of hay varied from 6 to 16 pounds, depending upon the amount of beet pulp in the ration and the size of the cow. The hay was a fair quality of oat with a slight admixture of bur-clover. The grain consisted of 8 pounds per head daily of a mixture of three parts of wheat bran and two parts of cocoanut-cake meal given dry in two feeds. Calculating this ration on a basis of 8 pounds of grain, 9 pounds of hay, and 60 pounds of beet pulp, it had a nutritive ratio of 1:6.2 and contained 21.75 pounds of dry matter.

The sugar-beet pulp was donated to the Station by the Alameda Sugar Company of Alvarado, through the kindness of the superintendent of the company, Mr. E. W. Burr. Transportation was furnished to Berkeley free on the first carload of pulp, and at half rates on the second carload, by the Southern Pacific Railroad Company.

The record of milk production, as given in the table below, began on September 5, 1900. From that date until October 10th the feed of the cows was hay and grain, as mentioned above. On the latter date, which was the sixth week in the table, beet pulp was given to all the cows in small quantities. This amount was so irregular, owing to the freshness of the pulp and the dislike of most of the cows for it in that condition, that a full ration of pulp was not secured until the seventh week. For the succeeding three weeks hay was fed once a day and beet pulp once, in amounts varying from 40 to 65 pounds per head, according to the size and appetite of the animal. Beginning with the tenth week, the hay, grain, and beet pulp were fed together, each in two daily feeds. With some of the cows the quantity of pulp given was increased 5 pounds per day until they received 80 pounds each, and with others decreased until they received only 20 pounds each. After a time the order was reversed; the rations for those receiving the large amounts were decreased, and for those receiving small amounts increased until two were receiving 90 pounds each daily. The period of feeding beet pulp closed during the sixteenth week, after which the cows received the former ration of hay and grain. During the whole period the cows had the range of several small fields, but the amount of food obtained there was of little practical value.

The beet pulp seemed to impart no foreign or disagreeable flavor to the milk. The milk was delivered daily to customers in Berkeley, and no complaint was made as to its quality. The effect of the pulp upon the flow of milk was on the whole beneficial. Most of the cows were decreasing in yield up to the time when we began to feed beet pulp, after which all increased in quantity, and continued to hold out well until the beet pulp was exhausted, when there was a noticeable decrease. In regard to the influence of beet pulp upon the percentage of fat in the milk, the records do not show any material effect either in raising or lowering the proportion of fat. The record of milk and fat production is given below, for the study of all who are interested therein.

The milk record was kept as follows: Each cow's milk was weighed at every milking as soon as drawn, and the weight recorded on a sheet provided for the purpose. At the same time about one half ounce of the milk was taken as a sample to test for fat, and placed in a bottle containing milk preservative. These composite samples were tested for fat once a week by the Babcock test. In the record, then, we have the weight of milk for each week, the average weekly per cent of fat, and the pounds of fat produced each week. This record is given in the table below, together with the quantity of beet pulp consumed by each cow per week.

INDIVIDUAL WEEKLY RECORD OF MILK AND FAT PRODUCED AND OF BEET PULP CONSUMED.

No. of Weeks....	NORMAN. JERSEY—SHORTHORN. Age 6 Years.				LINE BACK. ARYSHIRE—SHORTHORN. Age 5 Years.			
	Milk.	Fat.	Fat.	Beet Pulp.	Milk.	Fat.	Fat.	Beet Pulp.
	lbs.	*Per cent.*	*lbs.*	*lbs.*	*lbs.*	*Per cent.*	*lbs.*	*lbs.*
1......	156.3	4.5	7.03	----------	174.9	3.4	5.95	---------
2......	148.2	4.2	6.22	----------	183.4	3.3	6.05	---------
3......	154.8	3.8	5.88	----------	185.4	3.5	6.49	---------
4......	148.1	4.2	6.22	----------	182.3	3.4	6.30	---------
5......	138.8	4.4	6.11	----------	172.1	3.6	6.20	---------
6......	139.9	4.6	6.44	----------	165.5	3.6	5.96	---------
7......	154.4	4.4	6.79	365	171.7	4.2	7.21	355
8......	158.4	4.4	6.97	385	169.6	3.6	6.11	455
9......	142.9	4.4	6.29	385	174.7	3.7	6.46	435
10......	138.2	4.1	5.67	485	185.1	3.7	6.85	545
11......	128.6	4.2	5.40	560	189.1	3.8	7.19	560
12......	144.6	5.0	7.23	555	170.2	4.1	6.98	555
13......	147.2	4.8	7.07	385	183.4	3.9	7.15	385
14......	137.1	4.6	6.31	170	163.5	3.8	6.21	170
15......	141.1	4.5	6.35	140	175 0	3.7	6.48	140
16......	127.9	4.5	5.76	40	173.8	3.8	6.60	40
17......	123.5	5.0	6.18	----------	166.1	4.1	6.81	---------
18......	122.9	5.2	6.39	----------	167.9	4.1	6.88	---------
19......	121.1	5.2	6.30	----------	156.3	4.1	6.41	---------

INDIVIDUAL WEEKLY RECORD OF MILK AND FAT PRODUCED AND OF BEET PULP CONSUMED—*Continued.*

No. of Weeks....	STRUBE. JERSEY—SHORTHORN. Age 6 Years.				JERSEY. HIGH GRADE JERSEY. Age 10 Years.			
	Milk.	Fat.	Fat.	Beet Pulp.	Milk.	Fat.	Fat.	Beet Pulp.
	lbs.	*Per cent.*	*lbs.*	*lbs.*	*lbs.*	*Per cent.*	*lbs.*	*lbs.*
1......	176.5	3.7	6.63	----------	121.1	6.0	7.27	---------
2......	177.4	3.6	6.39	----------	120.7	5.6	6.76	---------
3......	175.7	3.4	5.97	----------	125.8	5.1	6.42	---------
4......	162.0	4.2	6.80	----------	119.6	5.6	6.70	---------
5......	144.4	3.8	5.49	----------	118.9	5.6	6.66	---------
6......	131.1	4.3	5.64	----------	123.4	5.6	6.91	---------
7......	141.7	3.9	5.53	295	129.1	5.8	7.49	380
8......	140.0	4.0	5.60	325	108.7	6.0	6.52	350
9......	144.9	3.9	5.65	335	114 6	5.5	6.30	420
10......	140.4	3.4	4.77	485	110 2	5.5	6.06	530
11......	156.3	4.1	6.41	560	117.1	5.5	6.44	560
12......	145.4	4.1	5.96	555	109.2	4.8	5.24	555
13......	142.4	4.1	6.84	385	104.0	5.2	5.41	385
14......	125.9	4.6	5.79	170	98.6	5.6	5.52	170
15......	128.9	4.1	5.28	140	105.2	5.5	5.79	140
16......	129.9	3.9	5.07	40	89.9	5.8	5.21	40
17......	123.2	4.3	5 30	----------	90.9	6.0	5.45	---------
18......	117.0	4.3	5.03	----------	89.9	6.5	5.84	---------
19......	111.9	4.1	4.59	----------	84.6	6.4	5.41	---------

Individual Weekly Record of Milk and Fat Produced and of Beet Pulp Consumed—*Continued.*

No. of Weeks.	IRENE. Grade Shorthorn. Age 6 Years.				SARAH. Grade Shorthorn. Age 6 Years.			
	Milk.	Fat.	Fat.	Beet Pulp.	Milk.	Fat.	Fat.	Beet Pulp.
	lbs.	*Per cent.*	*lbs.*	*lbs.*	*lbs.*	*Per cent.*	*lbs.*	*lbs.*
1	186.0	3.6	6.70	----------	149.6	3.6	5.39	----------
2	175.0	3.4	5.95	----------	147.0	3.5	5.15	----------
3	167.0	3.6	6.01	----------	145.5	3.2	5.66	----------
4	172.4	4.0	6.80	----------	130.6	3.6	4.70	----------
5	166.8	3.2	5.34	----------	*99.3	3.6	3.57	----------
6	156.4	4.0	6.26	----------	115.4	3.8	4.38	----------
7	180.8	3.6	6.51	295	125.5	3.8	4.77	200
8	176.6	3.7	6.53	315	125.4	4.2	5.27	350
9	186.2	3.6	6.70	340	130.0	3.6	4.68	350
10	167.2	3.1	5.18	215	110.0	3.5	3.85	215
11	163.0	3.7	6.03	140	114.9	4.1	4.70	140
12	163.4	3.4	5.56	145	112.6	3.7	4.17	145
13	177.2	3.6	6.38	315	119.9	3.6	4.32	315
14	186.0	3.6	6.70	530	132.6	3.8	5.04	530
15	194.4	3.4	6.61	560	141.4	3.4	4.81	560
16	175.9	3.6	6.33	160	119.5	3.7	4.42	160
17	153.7	3.8	5.84	----------	104.7	4.0	4.19	----------
18	156.3	3.7	5.78	----------	107.0	4.1	4.39	----------
19	144.6	3.8	5.49	----------	98.5	4.2	4.14	----------

*Sick.

Individual Weekly Record of Milk and Fat Produced and of Beet Pulp Consumed—*Continued.*

No. of Weeks.	KEOHAN. Grade Shorthorn. Age 8 Years.				GEORGIA. Grade Shorthorn. Age 6 Years.			
	Milk.	Fat.	Fat.	Beet Pulp.	Milk.	Fat.	Fat.	Beet Pulp.
	lbs.	*Per cent.*	*lbs.*	*lbs.*	*lbs.*	*Per cent.*	*lbs.*	*lbs.*
1	127.4	4.4	5.60	----------	165.6	3.6	5.96	----------
2	112.8	4.6	5.19	----------	169.4	3.8	6.44	----------
3	121.3	3.6	4.37	----------	168.0	3.6	6.05	----------
4	102.0	4.2	4.28	----------	152.5	3.7	5.64	----------
5	103.8	4.5	4.67	----------	147.9	3.2	4.73	----------
6	107.7	4.7	5.06	----------	145.3	4.0	5.81	----------
7	115.0	4.3	4.95	385	164.0	3.8	6.23	390
8	110.6	4.4	4.87	425	163.0	3.9	6.36	455
9	115.3	4.4	5.07	420	172.6	3.8	6.56	440
10	112.3	3.9	4.38	280	150.2	3.9	5.86	230
11	101.8	4.5	4.58	140	143.3	4.1	5.88	140
12	95.6	4.5	4.30	145	140.4	4.4	6.18	145
13	96.3	4.6	4.43	315	141.1	4.4	6.21	315
14	111.4	3.9	4.34	550	162.6	4.1	6.67	550
15	109.1	3.7	4.04	630	173.9	3.7	6.43	630
16	95.3	3.9	3.72	180	144.7	3.7	5.35	180
17	80.7	4.8	3.87	----------	120.1	4.0	4.80	----------
18	80.9	5.0	4.05	----------	127.0	4.2	5.33	----------
19	81.3	4.8	3.90	----------	124.3	4.2	5.22	----------

California Experience in Feeding Beet Pulp.—During the past year we submitted several questions to some of the leading stockmen of this State, with a view to gathering their experience in feeding sugar-beet pulp. The parties who have replied are: Messrs. Henry Miller, John L. Koster, John H. Wise, W. Mayo Newhall, all of San Francisco; Thomas H. Silsbee, of Point Conception; Fred D. Wiegman, of Alvárado; and Messrs. Vail and Gates, of Los Angeles. The questions asked and the answers of the different parties are here quoted.

Feeding Beef Cattle.—1. How much pulp do you feed daily per head?

Mr. KOSTER: 90 to 100 pounds.

Mr. WIEGMAN: About 100 pounds.

Mr. SILSBEE: An average of 112 pounds of siloed pulp.

Messrs. VAIL and GATES: A four-year-old steer will eat about 80 pounds of siloed pulp.

Mr. MILLER: About 100 pounds of fresh or 60 pounds of fermented pulp.

Mr. NEWHALL: The daily average consumed per animal will vary from 80 to 100 pounds. For animals of 1,000 to 1,100 pounds weight, the former quantity should suffice.

2. Do you feed hay or grain with the pulp, and if so, how much and of what kind?

Mr. KOSTER: 10 to 15 pounds uncut hay and 2½ to 5 pounds finely rolled barley—quantity regulated by condition of the cattle and the state of the weather. In cold weather a greater proportion of hay and barley than in warm weather.

Mr. WIEGMAN: About 5 pounds of oat hay and 3 pounds of mixed "chop" feed.

Mr. SILSBEE: 10 to 12 pounds of lima bean-straw.

Messrs. VAIL and GATES: About 6 pounds of barley hay and straw. Have generally fed about 8 pounds of ground corn for the last forty days of feeding. When we feed cotton-seed meal we give about 3 pounds per day.

Mr. MILLER: About 10 pounds of either alfalfa hay, grain hay, or straw chopped and mixed with grain, usually ground barley, though sometimes cracked wheat. The quantity of grain varies with the quality of the hay or straw. The better the hay the less grain used.

Mr. NEWHALL: We feed rolled barley and chevalier barley straw. The best result is obtained when the grain is crushed as finely as possible, the finer the better. Mill sweepings of grains, flour, corn, etc., are excellent. At the commencement of feeding the cattle a half pound of grain per day should be used, and a full ration would be 8 to 10 pounds daily. We were, from necessity, forced to use chevalier barley straw as a roughage, and from that experience, together with observation in the use of hay by others, I am decidedly of the opinion that such straw is far better; in fact, at the same price I would prefer the straw. In this connection I would beg to say that baled straw would have a market value of say $3 per ton, as against a value for baled hay of about $10 per ton.

3. How long is the period during which you feed beet pulp continuously?

Mr. Koster: During the winter months, covering a period of 90 to 120 days.

Mr. Wiegman: Until fat; usually four to four and a half months.

Mr. Silsbee: 90 days.

Messrs. Vail and Gates: From 100 to 120 days.

Mr. Miller: About four months.

Mr. Newhall: We fed during the season of 1900, 8,000 head of beef cattle covering a period of about four months; but the average time in which various lots were finished and sold was about two months. The usual period in this State of those who have fed is from three to four months, but this would depend upon and materially vary according to the temperament and to the condition of the animal at the commencement of the feeding period.

4. What is the effect of beet pulp in the production of meat?

Mr. Koster: On good, thrifty beef cattle the production of meat was superior to that of northern alfalfa-fed cattle. The meat was of fine flavor, good color, marbleized, and killing very white as to fat.

Mr. Wiegman: Makes white fat and tender and juicy meat.

Mr. Silsbee: Horned cattle gained an average of 1½ pounds per day, and dehorned cattle about 2 pounds per day.

Messrs. Vail and Gates: Fattens rapidly after the first 30 days' feed. Makes a fine quality of beef, the tallow being very white.

Mr. Miller: Has been more remunerative as a food for meat than for milk.

Mr. Newhall: Pulp fed with grain and hay or straw produces a very well-marbled condition of the meat; a decided effect of the pulp is the fine white color given to the carcass when dressed. I am of the opinion that, coupled with the result of confinement, the muscles and sinews of the animals are softened and less in evidence upon the block, thus making a much more acceptable article of meat for sale and use.

5. How much per ton do you consider you can afford to pay for pulp delivered at your ranch?

Mr. Koster: This would depend upon the value of other food materials.

Mr. Wiegman: $1 per ton.

Mr. Silsbee: Depends on the scarcity of cattle feed and the price of beef.

Messrs. Vail and Gates: After being siloed and well drained, 75 cents per ton. Have never fed at ranch; have always shipped cattle to factory.

Mr. Miller: It depends upon the price of beef. At present prices we can afford to pay 50 cents per ton for fresh and 75 cents per ton for fermented pulp.

Mr. Newhall: It would be difficult to economically feed pulp away from the factory, as transportation and handling of pulp is quite expensive. Factories sell pulp at from 10 to 25 cents per ton; the former price has been the custom when taken away from the factory, the latter when conveniences and facilities for feeding cattle have been furnished at or near the factories. I doubt any profitable use for beef-feeding at over 25 cents per ton for pulp. At this price, and the usual value of grain and hay or straw, it will cost from $9 to $12 per head to put the animal into good marketable condition. At the present and usual price of purchase and sale of cattle in California these figures ($9 to $12) are the full margin of profit when fattened on grass on the ranges and without any extra cost of feeding. I am of the opinion that under ordinary conditions in our State, except by small farmers, pulp, or in fact any feeding, can not be profitably carried on; but pulp is a most excellent thing to have in this State to fall back on in case of emergencies, like dry years and seasons when cattle do not properly fatten on the ranges. I believe, however, that small farmers who do their own work can purchase cattle, fatten them, and sell to a profit that would be satisfactory to them, especially as lots can be turned off every three or four months. This would be especially true of farmers in the localities where sugar beets are raised, and a long start made by feeding beet tops, and which would require but little time, say one month, for finishing on pulp with grain and hay.

Feeding Dairy Cattle.—Mr. Koster and Mr. Wiegman are the only ones reporting any extensive practice of feeding beet pulp for milk. Mr. Koster writes that he considers 20 to 25 pounds per head daily a sufficient amount of pulp for a dairy cow. With the pulp he feeds from 25 to 30 pounds of uncut hay and 5 pounds of middlings per day. He says there was no noticeable odor in the milk when feeding pulp, but that "too much pulp had the tendency to lessen the yield of milk as well as to impoverish it."

Mr. Wiegman replies that he considers 80 pounds of pulp per head daily a maximum amount to be fed with profit, and 20 to 25 pounds as a minimum. His usual feed is about 80 pounds per day. With the pulp he feeds 6 to 7 pounds of hay (oat preferred) and 6 pounds of mixed "chop" feed. He has pulp continually and feeds it throughout the year. If the cows are fed wholly on pulp the milk seems to become poorer. No foreign odor or flavor is noticeable in the milk, except occasionally when the beet pulp is fresh, none at all when feeding siloed pulp.

Feeding Other Stock.—Mr. Koster reports having fed beet pulp to sheep with good success, and adds: "In feeding pulp much depends upon the age and condition of the pulp, and upon the condition of the stock and suitable grounds for feeding."

Mr. Miller reports that they have fed pulp to sheep with satisfactory results, but do not consider it suitable to other animals than cattle.

Mr. Wise fed beet pulp to sheep only. He says: "Our experience was not very favorable. I am perfectly satisfied that beet pulp alone will not fatten stock of any kind. We had to buy other food to mix with it, otherwise our sheep would have fallen off instead of gaining flesh."

Additional Comments.—The experience given above shows clearly that beet pulp should not be depended upon as the sole diet for producing either milk or meat, the chief reason being that it does not adequately nourish the animal. When fed in connection with other and dry feed it not only serves to keep the digestion in a healthful condition, but adds materially to the store of actual food substance. The amount of pulp which can be fed profitably is reported, by all who feed for meat, as all the animals will readily consume in addition to the portion of hay or straw and grain, as already mentioned. In the case of the profitable quantity to feed for milk production there seems to be a wide difference of opinion. It may be that 25 or 30 pounds per day of pulp will induce as large a flow of milk as 80 pounds per day when the rest of the feed is dry; the notion being that the lesser quantity gives the cow all the succulent food and change of diet which she really requires for the best production. Where the pulp must be hauled a long distance and the cost of transportation is therefore great, it would undoubtedly be unwise to feed it in larger amounts than would give the necessary succulence to the ration, and 25 pounds is probably sufficient for this purpose. But where the dairy is situated adjacent to the sugar factory, as at Alvarado, it might pay to feed the pulp in much larger quantities.

Some further notes in regard to feeding beef cattle are worthy of consideration. Mr. Newhall writes: "I would further assume to say that, in my opinion, the climate of our State is not the most suitable for feeding purposes, especially in winter. I would particularly direct caution in undertaking to feed cattle during our winter months in small inclosures, where mud, exposure to dampness and winds have had a decidedly detrimental effect." In this connection Mr. Koster says: "When cattle are once started on pulp feed, particularly when fed to be fattened for beef, it is advisable to continue them at that until fully fat, and then to slaughter them. If cattle have been on this feed for a season, it is highly inadvisable, if they have reached the desired stage, to take them on green pasture, as this affects them seriously. Proper feeding grounds should be selected where the cattle can be sheltered during stormy weather."

ENTOMOLOGY AND PLANT DISEASES.

THE LONG-TONGUED BEES (APIDÆ) OF CALIFORNIA.

By CARROLL FOWLER.

[This article was prepared for the report of 1899, and is printed now as a part of the report of that year. Pressure of other matters has prevented further collecting along this line and with that the completion of the subject. It is, therefore, printed as originally written two years ago, and without including the subsequent generic alterations.]

One of the great drawbacks to the systematic study of this family is the scattered form in which the literature exists, making it impossible to carry on the work without a large collection of books, some of which are difficult to obtain. In the following paper one of the chief aims is to overcome this difficulty, as far as possible, by such synopses and notes as will enable a person in a short time to determine our common California forms without reference to other literature. We regret that the time would not permit an exhaustive study of all the genera represented in our fauna.

The material upon which this study is based represents a single year's (1898) collecting, most of which was done in the vicinity of Berkeley, yet quite a number of specimens were taken by Mr. H. O. Woodworth on a trip through southern California during May and June. Although the amount of material is small, still several new species and unknown sexes of named forms have been found. The former have been described in full, and published in entomological journals, while with the latter only those points are mentioned wherein they differ from the sex already described.* In arranging the species we have used as far as possible what we conceive to be the natural order, based, when practicable, upon structural characters, otherwise upon color pattern. In the synopses the simplest and most obvious characters that are constant have been employed.

APIS Linn.

Apis mellifica Linn. is our common honey bee, which occurs all over the State. In collecting, many of the black variety have been taken with occasionally an Italian cross. No other species belonging to this genus occur here.

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*It has not been deemed necessary to reprint in full those parts already published. The synopses and field notes have been reproduced with some slight changes. The genera thus treated are: Nomada (Entomological News, vol. 10, page 157), Synhalonia (Canadian Entomologist, vol. 31, page 137), Habropoda and Didasia (Canadian Entomologist, vol. 31, page 283), and Heriades and Calliopsis (Psyche, vol. 8, page 405).

BOMBUS Latr.

Of the bumble bees, *Bombus californicus* is the most common species here at Berkeley. *B. edwardsii* is also to be found rather abundantly most of the year, while *B. howardii* is common only in September and October. *B. fervidus* and *B. crotchii* are frequently met with in the southern part of the State, but rare here. *B. morrisonii* is to be found in the Mount Shasta region. *B. nevadensis*, *B. centralis*, and *B. occidentalis*, also recorded from California, are unknown to me.

Metathorax with yellow pubescence.
Thorax entirely yellow above.
Pubescence on head, at least above, yellow .... *morrisonii.*
Pubescence on head all black .... *nevadensis.*
Thorax with a black line between the bases of the wings.
Abdomen with yellow pubescence on first three segments.
First three segments entirely yellow .... *fervidus.*
Black spot on disc of segments 2–3............... *centralis.*
Abdomen with the fourth and fifth segments yellow.
First segment yellow.......................... *edwardsii.*
First segments without yellow .... *occidentalis.*
Metathorax with black pubescence.
Second abdominal segment yellow.
Second and third segments yellow .... *howardii.*
Second segment only yellow .... *crotchii.*
Second abdominal segment black........................ *californicus.*

1. *Bombus morrisoni* Cress. Mount Shasta, Cal. (Miss K. Jones); one specimen. Previously recorded from Nevada, Colorado, and New Mexico. A specimen in my collection from Arizona.

2. *Bombus nevadensis* Cress.

3. *Bombus fervidus* Fabr. San Diego, Cal.; May 18; four specimens. Berkeley; October 21; one specimen.

4. *Bombus centralis* Cress.

5. *Bombus edwardsii* Cress. Berkeley and San Francisco, Cal.; February–October; many specimens.

6. *Bombus occidentalis* Greene.

7. *Bombus howardii* Cress. Berkeley, Cal.; September–October; eighteen specimens.

8. *Bombus crotchii* Cress. Tulare and Ventura, Cal.; May–June; three specimens.

9. *Bombus californicus* Smith. Berkeley, Cal.; February–November; fifty-five specimens. Redondo and San Diego, Cal.; May; seven specimens.

CENTRIS Fabr.

Although this semi-tropical group is fairly well represented in the southern part of the United States, none have heretofore been recorded from this State. It is probable that several species occur in southern California. The only one known to me is *C. hoffmanseggiæ* Ckll., one specimen of which was collected by Mr. H. O. Woodworth at Redlands, Cal., June 3, 1898.

XYLOCOPA Fabr.

This group, popularly known as carpenter-bees, is represented in California by four species, none of which are common at Berkeley, although *X. orpifex* has been collected in this vicinity. *X. varipuncta* is quite common in southern California, *X. fimbriata* has been recorded from the Yosemite Valley, and *X. californica* is probably common in the redwood region of the northern portion of the State.

Length, 15½ m.m.; ♀, labrum fringed with ferruginous hairs; ♂, with yellow markings on face............*orpifex.*
Length, 20½ m.m. or more; ♀, labrum with black hairs; ♂, face with yellow.*
  Bluish green; ♀, without pits behind the posterior ocelli; ♂, with white band on apical margin of fourth segment ....*californica.*
  Black; ♀, with small pits behind the posterior ocelli...*varipuncta* ♀

1. *Xylocopa orpifex* Smith. Sausalito, Cal. (Miss Henrici); one female.

2. *Xylocopa californica* Cress. ♀

♂ differs from ♀ in having the process on the labrum entire instead of emarginate, the pubescence on the thorax above whitish mixed with some black hairs and tinged with yellow anteriorly; a patch of white pubescence beneath the base of the wings; first abdominal segment and apical margin of the fourth with dense, whitish pubescence, that on the last three segments rather dense and black; the apical segment without carinæ.

Oakland, Cal. (Henderson); January 19. Fifteen females and ten males taken from a piece of redwood, eleven of which were found in one burrow. All had reached maturity. The wood probably came from the redwood region of northern California.

3. *Xylocopa varipuncta* Patton. Redlands, Duarte, Rivera, and Santa Ana, Cal.; May 25–July 17; nine females. Previously recorded from Arizona and Lower California.

4. *Xylocopa fimbriata* Fabr. Yosemite Valley.

ANTHOPHORA Latr.

The bees of this genus at first glance seem to separate naturally into two groups, according as to whether or not the pubescence of the abdomen is appressed; yet the correct natural classification should probably be based upon the structure of the apical abdominal segment of the males. However, with the small amount of material at hand, the relationship based upon this character can not be readily distinguished, so that the former has necessarily been the one used in making out the synopsis.

A. edwardsii and *A. urbana* are the most common at Berkeley, the former being especially noticeable in the early spring, while the latter appears in May and remains with us until November.

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* *X. fimbriata* (unknown to me) may be distinguished from *X. californica* and *X. varipuncta* by the following characters: "♀, with a ridge on vertex, interrupted in the middle, forming lateral tubercles or horns outside of posterior ocelli; ♂, apex of abdomen densely covered with long, rufo-fulvous pubescence."

Abdomen with appressed pubescence, except on first segment.
Appressed pubescence covering the whole of the segments .... *exigua.*
Appressed pubescence forming bands on the apical margins of the segments.
♂, with sides of the face black; ♀, clypeus and labrum with some yellow.
♂, scape yellow in front; ♀, yellow spot on middle of face.*............................ *maculifrons.*
♂, scape black; ♀, no yellow spot above clypeus..*curta.*
♂, sides of the face white; ♀, face entirely black†...*urbana.*
Abdomen with erect pubescence.
Thorax with uniform pale or fulvo-orchraceous pubescence, sometimes mixed with black.
Pubescence of the thorax cinerous; ♂, mandibles black.
Wings hyalin, except on apical margins; the black pubescence on abdominal segments 3–4 short; ♂, intermediate tarsi with short pubescence..*edwardsii.*
Wings slightly dusky, the black pubescence on segments 3–4 rather long; ♂, intermediate tarsi densely ciliated with long white pubescence...*pacifica.*
Pubescence of the thorax fulvo-ochraceous; ♂, mandibles yellow, except at tips....................*crotchii.*
Mesothorax with dense ochraceous pubescence, that on metathorax black............................*solitaria.*

1. *Anthophora exigua* Cress. Alhambra, Cal.; June 23; one specimen. Fresno, Cal.; October 15; two specimens.

2. *Anthophora maculifrons* Cress. Alhambra and Redlands, Cal ; June; seven males.

3. *Anthophora nigrocincta* Prov. Los Angeles.

4. *Anthophora 5-faciata* Prov. Los Angeles.

5. *Anthophora curta* Prov.

Provancher's description of the female of this species agrees very well with the males that I have. The structure of the apical segment probably misled him in regard to the sex, for instead of being bidentate as in *A. maculifrons*, it is not unlike the ordinary female, having the apical tooth elongate and rounded at the apex.

♀ differs from ♂ in being a little more robust and having the pubescence on the face thinner, that on the posterior legs long and dense and on the middle of the fifth segment black. The abdomen is without spines.

Fresno, Tulare, and Anaheim, Cal.; May; three specimens.

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*A. *nigrocincta* Prov. seems to be closely allied to *A. maculifrons*. *A. 5-faciata* Prov. is a little larger than these two, also seems to differ in not having a yellow line above the clypeus.

†*A. californica* ♂ seems to differ from *A. urbana* in having the posterior legs very robust and their metatarsi with a long flattened process within.

6. *Anthophora urbana* Cress. ♂

♀ differs from ♂ in being more robust and having the face entirely black, and the posterior tibiæ and metatarsi with long, dense pubescence.

Fresno, Tulare, Santa Ana, and Berkeley, Cal.; May–October; many specimens.

7. *Anthophora californica* Cress.

8. *Anthophora edwardsii* Cress. Berkeley and Ocean View, Cal.; March–May; numerous specimens.

9. *Anthophora pacifica* Cress (= *A. ignava* Cress.). Berkeley, Cal.; January 28–May 11; twelve specimens. There seems to be no doubt but that the female of *A. pacifica* and *A. ignava* are identical.

10. *Anthophora crotchii* Cress. Berkeley, Cal.; May 1; two males.

11. *Anthophora solitaria* Rits. (*insulanis* Smith) ♀. Santa Catalina Island and San Bernardino, Cal.; June; seven specimens. Previously recorded from Vancouver Island.

HABROPODA Smith.

A small group of bees, comparatively local in their habits, and in appearance very much like the larger species of *Anthophora*.

Legs with black pubescence .... *floridana.*
Legs with pale pubescence.
  Abdomen (except on first segment) with depressed
    pale pubescence interspersed with erect black hairs;
    ♂, scape yellow in front .... *depressa.*
  Abdomen without black hairs, pale pubescence erect;
    ♂, scape black .... *miserabilis.*

1. *Habropoda floridana* Smith. Redondo, Cal.; May 23; one female.

2. *Habropoda depressa* Fowler. Berkeley, Cal.; February 22–May 1; twenty-five specimens. Santa Catalina Island, Cal.; June 21; one specimen. During the earlier part of the season several specimens were collected upon the white flowers of Cytisus poliferus in the Botanic Garden. About the middle of April quite a number of females were observed collecting pollen from oak trees. A few males were collected upon Ranunculus californicus.

3. *Habropoda miserabilis* Cress. San Francisco, Cal.; April; twenty specimens collected, chiefly upon Phacelia californica.

DIDASIA Patton.

The bees of this genus fly somewhat later in the season. They are generally quite pubescent. None of the species are common at Berkeley, but *D. enavata* is very abundant in southern California during the early summer.

Abdomen with black pubescence, except on segments 1–2;
  not banded .... *nerea.*
Abdomen with pale pubescence; white bands or faciæ on
    apical margins of the segments.
  Length about 8 m.m. .... *alboresta.*

Length 11 m.m. or more.
Tarsi dark brown or black; ♂, with third antennal joint slender, three times the length of the second.......*cinerea.*
Tarsi pale ferruginous; ♂, with third antennal joint not especially slender, about twice the length of the second.......*enavata.*

1. *Didasia nerea* Fowler. Tulare, Cal.; May 10; two specimens.
2. *Didasia alboresta* Prov. Los Angeles, Cal.
3. *Didasia cinerea* Fowler. Berkeley, Cal.; May–June; three males.
4. *Didasia enavata* Cress. Santa Catalina Island, Santa Barbara, and Redlands, Cal.; June; numerous specimens.

SYNHALONIA Patton.

This genus has been more or less confused with *Melissodes*, and it is possible that some of the species ascribed to the latter really belong with *Synhalonia*. *S. californica* and *S. albopilosa* are met with rarely, while *S. intrudens* and *S. edwardsii* are quite abundant in the spring.

Abdomen with distinct, white bands.
Small, not more than .25 inch in length.......*albicans.*
At least .40 inch in length.
Clothed with white pubescence, rather thin on thorax above.......*californica* ♀
Clothed with dense reddish-brown pubescence.......*spheciosa* ♀
Abdomen not distinctly banded.
Pale pubescence of the abdomen confined to the first segment.
Thorax with dense brownish pubescence.......*acerba.*
Thorax with rather thin white pubescence.......*albopilosa* ♂
Pale pubescence extending more or less upon the second abdominal segment.
Third joint of the antennæ shorter than the first.......*edwardsii* ♂
Third joint as long as the first and second combined.......*intrudens* ♂

1. *Synhalonia albicans* Prov. San Gabriel, Cal.; June 23; twelve specimens.
2. *Synhalonia californica* Fowler. Berkeley, Cal.; May 1 and 9; thirteen specimens.
3. *Synhalonia spheciosa* Cress. Berkeley, Cal.; April 26–May 1; two females.
4. *Synhalonia acerba* Cress. Berkeley, Cal., six specimens; and San Mateo County, Cal., two specimens. April and May. Collected upon Brassica campestris and Ranunculus californicus.
5. *Synhalonia albopilosa* Fowler. Berkeley, Cal.; April 13; one specimen, collected upon Ranunculus californicus.
6. *Synhalonia edwardsii* Cress. Berkeley, Cal.; March 15–May 9; sixteen males, collected upon Brassica campestris, Ranunculus californicus, and Malvastrum capense.
7. *Synhalonia intrudens* Cress. Berkeley, Cal.; March, fourteen males; April 26, one male. Tulare, Cal.; May 10, three males. Collected chiefly upon Brassica campestris.

XENOGLOSSA Smith.

A small group of bees especially noticeable for their beautiful reddish pubescence. Two species are to be found in the southern part of this State, *X. pruinosa* being very common there.

Second sub-marginal cell almost quadrate ....*pruinosa.*
Second sub-marginal cell distinctly longer beneath than
  above ....*cucurbitarum.*

1. *Xenoglossa pruinosa* Say. Redlands, Pomona, Los Angeles, and Ventura, Cal.; June–July. Numerous specimens collected in wild goard and morning-glory blossoms.

2. *Xenoglossa cucurbitarum* Ckll. Riverside, Cal.; May 10; one female. The specimen is somewhat smaller than Cockerell's type, being only 17½ m.m. in length. The second sub-marginal cell is decidedly longer beneath than above, and may differ from *X. cucurbitarum* in that respect also. If such be the case it is probably a new species.

MELISSODES Latr.

Although this is one of the largest genera of bees, California seems to be poorly represented. In the collection of the University of California are only four species which represent our common forms, while ten are recorded from this State. The species in some cases are very difficult to distinguish and often quite variable in color and markings, so that a large series may probably bring together many of those described as distinct forms. At Berkeley the most common is *M. lupina.* The species taken by us fly during the summer and early fall. The following synopsis will serve to separate those we have collected here:

Four anterior legs, with dark brown pubescence; length,
  15 m.m. ....*obliqua.*
Four anterior legs, with pale pubescence; length, 11 m.m.
  or less.
    ♀, with apex of abdomen fulvous; ♂, labrum black or
      with a yellow spot on the middle basal portion..*menuacha.*
    ♀, with the two apical abdominal segments black or
      nearly so; ♂, labrum entirely yellow.
      Pubescence pale-ochraceous, on segments 3–4 dense,
        depressed, almost covering the surface; ♂, fifth
        segment without lateral teeth ....*tepida.*
      Pubescence griseous, that on segments 3–4 consisting of narrow white bands; ♂, with lateral teeth
        on both fifth and sixth abdominal segments ....*lupina.*

1. *Melissodes obliqua* Say. ♂

♀ agrees closely with the description of ♂, but, as is usual with the females of this group, the face is entirely black, the antennæ quite short, and the posterior legs have long, dense pubescence.

Fresno, Cal.; October 15; one female.

2. *Melissodes menuacha* Cress. ♂

♀ very closely resembles ♂ in size and appearance, with the usual exception, viz., the short antennæ, black face, and apical segments without lateral teeth. The pubescence on the posterior legs is not so dense and long as in the other species before me.

The males show marked variation in the coloring of the face. Most of the specimens have mandibles entirely black and the labrum with a yellow spot at the base. Some have the pubescence on the disc of the thorax mixed with black.

Highlands and Lordsburg, Cal.; June; seventeen specimens. Berkeley, Cal.; September; six specimens. Previously recorded from Colorado, Texas, Nevada, New Mexico, and Oregon.

3. *Melissodes tepida* Cress. ♀

♂, length 9 m.m., differs from ♀ in being 4 m.m. shorter, having the pubescence on the face more dense, the clypeus (except a small dot near each side), labrum, and spot on base of mandibles yellowish-white. antennæ three-fourths the length of the body, and the sixth abdominal segment with an acute tooth on each side.

Alhambra, Redlands, and Lordsburg, Cal.; June; ten specimens. Fresno, Cal.; October 15; one specimen. Berkeley, Cal.; October; eight specimens. Previously recorded from Nevada.

4. *Melissodes lupina* Cress. ♂

♀, length 10 m.m., closely resembles ♂, but is a little larger, the face being almost bare and without yellow markings; the antennæ short and black at base; apical segments of the abdomen are without lateral teeth.

Berkeley, Cal.; July–October; numerous specimens.

The following have been recorded from California, but are unknown to me:

Melissodes bituberculata Cress.
Melissodes californica Cress.
Melissodes nigrofrons Cress.
Melissodes stretchii Cress.
Melissodes actuosa Cress.
Melissodes olivacea Cress.

CERATINA Latr.

This is a very distinct group of small green bees known as the small carpenter-bees. *C. dupla* is rare at Berkeley, but fairly common in southern California. *C. tejonensis* is quite common, being especially abundant upon the yellow wildflowers in the spring.

Tubercles white ....*dupla.*
Tubercles green* ....*tejonensis.*

1. *Ceratina dupla* Say. Berkeley, Cal.; March; two specimens, collected upon Brassica campestris and Ranunculus californicus. Santa Catalina Island, Cal.; June; five specimens.

2. *Ceratina tejonensis* Cress. ♂

♀ closely resembles ♂, but is usually a little larger; the face is green, with sometimes a white longitudinal mark in the middle of the clypeus; the posterior femora are simple.

Berkeley, Cal.; February–September; numerous specimens, collected largely upon Brassica campestris and Ranunculus californicus. Pomona, Santa Ana, and Santa Monica, Cal.; June; four specimens.

3. *Ceratina acantha* Prov. ♀ Los Angeles, Cal.

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*According to Provancher, *C. acantha* Prov. ♀ differs from *C. tejonensis* in having the "posterior claws simple." This species is unknown to me.

MEGACHILE Latr.

Owing to the small number of specimens at hand and the poor condition of many of these, this group—popularly known as the leaf-cutter bees—could not be satisfactorily disposed of. *M. frigida* is the common species here at Berkeley. *M. brevis* is also found here, but is not so abundant. It may be readily distinguished by its whitish pubescence from *M. frigida*, which is yellowish.

The following are known to occur in California:

M. frigida Smith.
M. latimus Say.
M. pugnata Say.
M. fidelis Cress.
M. montivaga Cress.
M. brevis Say.
M. exilis Cress.
M. studiosa Cress.

ANTHIDIUM Fabr.

This genus includes some of our most handsome bees. They are quite conspicuous, yet difficult to capture, on account of their restless nature and exceeding quickness of movement. Of the ten species recorded from California there are four in the University collection.

Yellow line behind the eyes, only slightly interrupted on vertex .... *illustre.*
Small yellow spot behind each eye.
Face with yellow markings.
♀, with broad black band down the middle of the clypeus; ♂, thorax with yellow markings ...... *maculifrons.*
♀, with clypeus black at base and yellow on anterior margin; ♂, thorax black .... *californicum.*
Face black.. *palliventre.*

1. *Anthidium illustre* Cress. ♀

♂ differs from the description of ♀ in having the sides of the face yellow, no yellow spot beneath the tubercles, the yellow bands of the abdomen more or less emarginate on each side posteriorly, the sixth segment yellow except a slight interruption in the middle and sides with a short spine, the apical segment yellow except a small spot on each side, and the posterior margins on each side extending into a large wedge-shaped tooth, and between these a short, blunt, black spine. The female is unknown to me, yet these males agree so closely with the description that there can be little doubt of their being *illustre.*

Redlands, Cal.; June 3; two males.

2. *Anthidium maculifrons* Cress. Berkeley, Cal.; June 23–July 1; seventeen specimens, collected upon Scutellaria californica.

3. *Anthidium californicum* Cress. ♂

♀ differs from ♂ as follows: Base of clypeus black—sometimes the black is reduced to a small loop or two spots—a spot on each side of the anterior margin of the mesothorax, sometimes one just above the tegulæ, and two to four spots on the posterior margin of the scutellum yellow; apex of the abdomen without spines or teeth. The males that I have seen differ from the description in having the stigma more or less yellow. The tubercles are usually yellow. The amount of yellow on the legs is also quite variable.

Berkeley, Cal.; April 23–June 4; fifteen specimens, collected chiefly upon Scutellaria californica. Redlands, Cal.; June 3; four males.

4. *Anthidium palliventre* Cress. Ventura, Cal.; June 15; one female.

The following have been recorded from California, but are unknown to me:

Anthidium atriventre Cress.
Anthidium consimile Ashm.
Anthidium compactum Prov.
Anthidium edwardsii Cress.
Anthidium emarginatum Say.
Anthidium 3-cuspidum Prov.

ALCIDAMEA Cress.

This genus is represented in the United States by only two species, one of which, *Alcidamea producta* Cress., occurs in this State. It is remarkable for the amount of variation in size. In the University collection are five females, varying all the way from 5½ m.m. to 10 m.m. in length, and appearing at first sight to be five different species. One of these is from Illinois, while the others were collected by Mr. H. O. Woodworth at Tulare, Ventura, and Alhambra, Cal., in May and June of 1898.

CHELOSTOMA Latr.

Chelostoma californicum Cress. is the only species of this genus known from California. In my collection is one male specimen taken at Berkeley, Cal., April 23, 1898. The deeply excavated disc of the apical segment and the large, transverse, obtuse elevation on the second ventral segment will serve to distinguish this from the other males of the genus. The female is unknown.

HERIADES Spin.

Only one specimen, *H. glaucum* Fowler, belonging to this genus, has been collected at Berkeley. It is quite distinct from most others of this group, on account of its bluish-green color. *Heriades albicinctum* Prov., recorded from Los Angeles, is the only other species known from this State.

OSMIA Panz.

The species of this genus are as a rule very difficult to distinguish and seem to be quite variable. As the series in our collections are not very large, the classification has not proved thoroughly satisfactory in every case. On this account I omit the usual notes and descriptions. Several of these are new to this State, while four recorded from California are unknown to me. The following table is purely arbitrary in character, but it will aid the student in separating the common species of this region:

Pubescence bright red, color bronze-green .... *rustica.*
Pubescence all white, both above and beneath .... *albiventris.*
Pubescence beneath more or less black, above pale yellow to black.
  Of a bright green color; very small; pubescence above pale yellow .... *exigua.*
  Color dull green, bluish or black.
    Clypeus of ♀ emarginate; antennæ of ♂ reaching base of abdomen .... *lignaria.*
    Clypeus of ♀ truncate or entire; antennæ of ♂ not reaching the base of the abdomen.
      Narrow white bands on apical margins of abdominal segments .... *purpurea.*
      Abdomen not banded.
        Legs and body of a cobalt or greenish color; wings dark .... *cobaltina.*
        Legs black; wings sub-hyalin or clear.
          Dark blue-green, clothed with pale, ochraceous pubescence, short and mixed with fuscous beneath; flagellum tinged with rufo-testaceous beneath .... *dubia.*
          Clothed above with ochraceous and beneath with black pubescence; antennæ black.
            Color deep blue; length .32 in. (8 m.m.) .. *brevis.*
            Color black, tinged with dark blue; length .45 in. (11 m.m.) .... *nigrifrons.*

The following occur in California:

1. *Osmia atreventris* Cress. Unknown to me.
2. *Osmia dubia* Cress.
3. *Osmia purpurea* Cress.
4. *Osmia legnaria* Cress.
5. *Osmia nigrifrons* Cress.
6. *Osmia brevis* Cress.
7. *Osmia quadriceps* Cress. Unknown to me.
8. *Osmia maura* Cress. Unknown to me.
9. *Osmia californica* Cress. Unknown to me.
10. *Osmia cobaltina* Cress.
11. *Osmia albiventris* Cress.
12. *Osmia rustica* Cress.
13. *Osmia exigua* Cress.

BOMBOMELECTA Patton.

B. separata and *B. edwardsii* are classed here as belonging to *Bombomelecta*, on account of the maxillary palpi, which are six-jointed. Three species are represented in our fauna.

Black bands between the wings .... *separata.*
Pubescence on thorax above all pale.
  First abdominal segment with pale pubescence ...... *thoracica.*
  First abdominal segment with black pubescence ..... *edwardsii.*

1. *Bombomelecta separata* Cress. Berkeley and Ocean View, Cal.; March–April; five specimens. These specimens differ from Cresson's description in having a patch of white pubescence on each side of some of the abdominal segments, usually 3–4, but sometimes 2–5. As these are variable in size, they are probably of no specific value.

2. *Bombomelecta thoracica* Cress. Berkeley, Cal.; February 4–March 3; two specimens, collected upon Brassica campestris.

3. *Bombomelecta edwardsii* Cress. Ocean View, San Mateo County; April; three specimens.

MELECTA Latr.

Melecta californica Cress. is the only species of this genus known from our State, although several have been recorded from Nevada. It, however, seems to be quite widely distributed, as we have specimens from Berkeley, Redlands, and Fresno, Cal., collected from June to October.

EPEOLUS Latr.

The bees of this genus are said to be parasitic upon the species of Colletes. *E. californicus* is the only common one at Berkeley.

Tibial spurs ferruginous..*compactus.*
Tibial spurs black.
  Legs ferruginous..*occidentalis.*
  Legs black..*californicus.*

1. *Epeolus compactus* Cress. Santa Catalina Island and Highlands, Cal.; June; two males.

2. *Epeolus occidentalis* Cress. Fresno, Cal.; October 15; one female.

3. *Epeolus californicus* Cress. Berkeley, Cal.; June–September; seven specimens. Fresno, Cal.; October 15; two females.

Recorded from California, but unknown to me, are:

Epeolus concavus Cress.
Epeolus nigriceps Smith.
Epeolus faceatus Prov.
Epeolus superbus Prov.

NOMADA Fabr.

Among the most characteristic of our early spring bees are those of the genus *Nomada*, which are to be found rather abundantly upon our yellow spring wildflowers. The species exhibit a great deal of variation in color and also in the wing venation. The latter character can not be used at all in classifying, because in the single species, *bisignata*, of which we have a large series, all the extremes of variation in the venation are to be found. The color pattern, although variable, seems to be the most reliable for classification. The following synopsis is an attempt at the natural classification of the California species known to me, with the probable position of the other California species indicated in footnotes:

- Bright yellow markings on black ground, with very little brown.
    - Second abdominal segment broadly yellow, two large yellow spots on the metathorax.
        - Second joint of flagellum as long or longer than third.
            - No yellow markings on disc of thorax.
                - Fifth abdominal segment not entirely yellow .. *vinnula.*
                - Fifth abdominal segment entirely yellow ..... *suavis.*
            - Yellow markings on disc of thorax .... *edwardsii.*
        - Second joint of flagellum shorter than third .... *citrina.*
    - Yellow on second segment narrowed or interrupted; metathoracic spots feeble, usually wanting.
        - Legs largely yellow; fifth abdominal segment almost entirely yellow.
            - Yellow band on second abdominal segment not interrupted; the second joint of the flagellum slightly shorter than the third .... *civilis.*
            - Second abdominal segment distinctly interrupted; second joint of the flagellum about one third the length of the third .... *rivalis.*
        - Legs black with brown markings; broad basal portion of the fifth abdominal segment black.
            - Yellow bands of the abdomen entire .... *fragilis.*
            - Yellow bands on segments 2–4 broadly interrupted .... *interrupta.*
- Reddish-brown and black, sometimes with pale yellow lateral markings on the abdomen.
    - Second abdominal segment with large, whitish, lateral markings connected by a narrow medially interrupted line near the posterior edge .... *crotchii.*
    - Lateral markings when present yellowish and not extending medially.
        - On the sides of the abdominal segments a large basal black spot crowding the yellow into a narrow, oblique line .... *obliquella.*
        - Black spots small or wanting.
            - Broad base of segments 1–4 black .... *obscurella.*
            - Little or no black on base of segments 1–4.
                - Fifth abdominal segment with two yellow spots or a broad band.
                    - General color pale ferruginous .... *opposita.*
                    - General color dark.
                        - Scutellum sub-bilobate, with yellow spots .. *vincta.*
                        - Scutellum not prominent, black .... *lepida.*
                - No yellow on fifth segment.
                    - Thorax black, abdomen reddish .... *melliventris.*
                    - Thorax and abdomen reddish.
                        - Unicolorous .... *rubra.*
                        - Marked with black, abdomen often with lateral yellow spots .... *bisignata.*

1. *Nomada vinnula* Cress. Fresno, Cal.; May 4; two specimens, collected upon Melilotus indica. Alhambra and Pomona, in Los Angeles County, Cal.; June; five specimens.
2. *Nomada suavis* Cress.
3. *Nomada edwardsii* Cress.
4. *Nomada citrina* Cress.
5. *Nomada civilis* Cress. Berkeley, Cal.; March 28; four males, collected upon Ranunculus californicus and Brassica campestris.
6. *Nomada rivalis* Cress. Berkeley, Cal.; April 18; two males.
7. *Nomada flavipes* Prov. Los Angeles, Cal.
8. *Nomada fragilis* Cress. Berkeley, Cal.; May 19; one male.
9. *Nomada interruptella* (=*interrupta* Fowler, preoccupied). Berkeley, Cal.; March 16; one specimen.
10. *Nomada crotchii* Cress. San Mateo County, Cal.; April 13; one specimen.
11. *Nomada obliquella* (=*obliqua* Fowler, preoccupied). Berkeley, Cal.; March 28–April 12; two specimens, collected upon Ranunculus californicus.
12. *Nomada obscurella* (=*obscura* Fowler, preoccupied). Berkeley, Cal.; March 18; one specimen, collected upon Ranunculus californicus.
13. *Nomada opposita* Cress.
14. *Nomada vincta* Say. Berkeley, Cal.; May; two specimens.
15. *Nomada lepida* Cress. Berkeley, Cal.; February, March, April; twenty-six males, collected upon Ranunculus californicus and Brassica campestris.
16. *Nomada melliventris* Cress. Berkeley, Cal.; March 15–April 18; ten specimens, collected upon Brassica campestris and Ranunculus californicus.
17. *Nomada rubra* Prov. Fresno, Cal.; April 28; six females, collected upon Eschscholtzia californica and Medicago sativa.
18. *Nomada bisignata* Say. Berkeley, Cal.; March 15–April 13; thirty-six specimens, collected upon Ranunculus californicus.

var. *rubrica* Prov. Berkeley and Visalia, Cal.; March, May, and June; seven specimens.

CALLIOPSIS Smith.

We have collected six of the California species. Of these, *C. atriceps* is the only one taken at Berkeley; it being, however, quite common here. The following synopsis will serve to separate these:

First recurrent vein uniting with the second transverso-cubital vein.
  ♂, with clypeus yellow; ♀ dull black, veins black, apical plate narrow .... *clypeatus.*
  Both ♂ and ♀ entirely jet black; ♀, with apical plate fairly broad, veins pale .... *atriceps.*
First recurrent vein received by the second sub-marginal cell some distance from the second transverso-cubital vein.
  Abdominal bands entire.
    Postscutellum white .... *scutellaris* ♂
    Postscutellum black .... *cinctus.*

Abdominal bands interrupted.
  Abdomen with four yellow bands, the first two of which are broadly interrupted on the disc ...... *visaliensis* ♀
  Abdomen with five yellow bands which are broadly interrupted laterally and narrowly so in the middle .... *anthidius* ♀

1. *Calliopsis clypeatus* Cress. St. Helena, Cal.; March 26; fourteen specimens, collected upon Brassica campestris.
2. *Calliopsis atriceps* Cress. Berkeley, Cal.; March and April; many specimens, collected chiefly upon Brassica campestris and Ranunculus californicus.
3. *Calliopsis scutellaris* Fowler. Fresno, Cal.; May 4–9; seven males, collected upon Melilotus indica.
4. *Calliopsis cinctus* Cress. Tehachapi, Cal.; May 12; one male.
5. *Calliopsis visaliensis* Fowler. Visalia, Cal.; May 9; one specimen.
6. *Calliopsis anthidius* Fowler. Tulare, Cal.; May 10; one specimen.

Others recorded from California, but unknown to me, are:

Calliopsis zonalis Cress.
Calliopsis edwardsii Cress.
Calliopsis obscurellus Cress.
Calliopsis albitarsis Cress.
Calliopsis californicus Cress.

PANURGUS Panz.

Only two species belonging to this genus have been recorded from California. *Panurgus chabylæus* Cress. is the common one at Berkeley, and is found abundantly upon yellow flowers in March and April. It is easily distinguished by its steel-blue color. *P. regularis* Cress. is unknown to me.

BROWN ROT OF STONE FRUITS.*

By Frederic T. Bioletti.

Brown Rot is one of the most serious diseases with which fruit-growers have to contend. It attacks principally stone fruits—peaches, plums, apricots, and cherries—but occasionally does damage to apples, pears, and quinces. It is widely distributed throughout Europe and the United States. In some of the Eastern States it is considered the most destructive disease with which the peach-grower has to contend. In Delaware and Georgia it often destroys from 25 to 75 per cent of the crop. It is reported to destroy more peaches and cherries in Michigan than all other diseases combined. In Kentucky it is said to be very destructive to apples, and in Oregon it has been the cause of very serious losses to the prune-growers for several seasons. In California, though its occurrence has been noted for several years, no serious damage seems to have been occasioned until last year, when it appeared abundantly in several localities. Statements were received from prune-growers in Napa County that 50 per cent of the crop was rotting in some orchards, and specimens of the diseased fruit received by the Experiment Station at Berkeley showed Brown Rot to be the cause. In several large orchards in Alameda County the late varieties of apricots were seriously affected; 25 per cent or more of the crop being destroyed in some cases. All the cases of this disease which have so far been brought to the notice of the Station have been in localities not far from the sea, and therefore more or less under the influence of the summer sea fogs. As there seems, however, to be a tendency of the disease to spread in California, and as recent experiments in Georgia and elsewhere show that it can be controlled with comparative ease, the following brief description of the disease and of the method of treatment is given:

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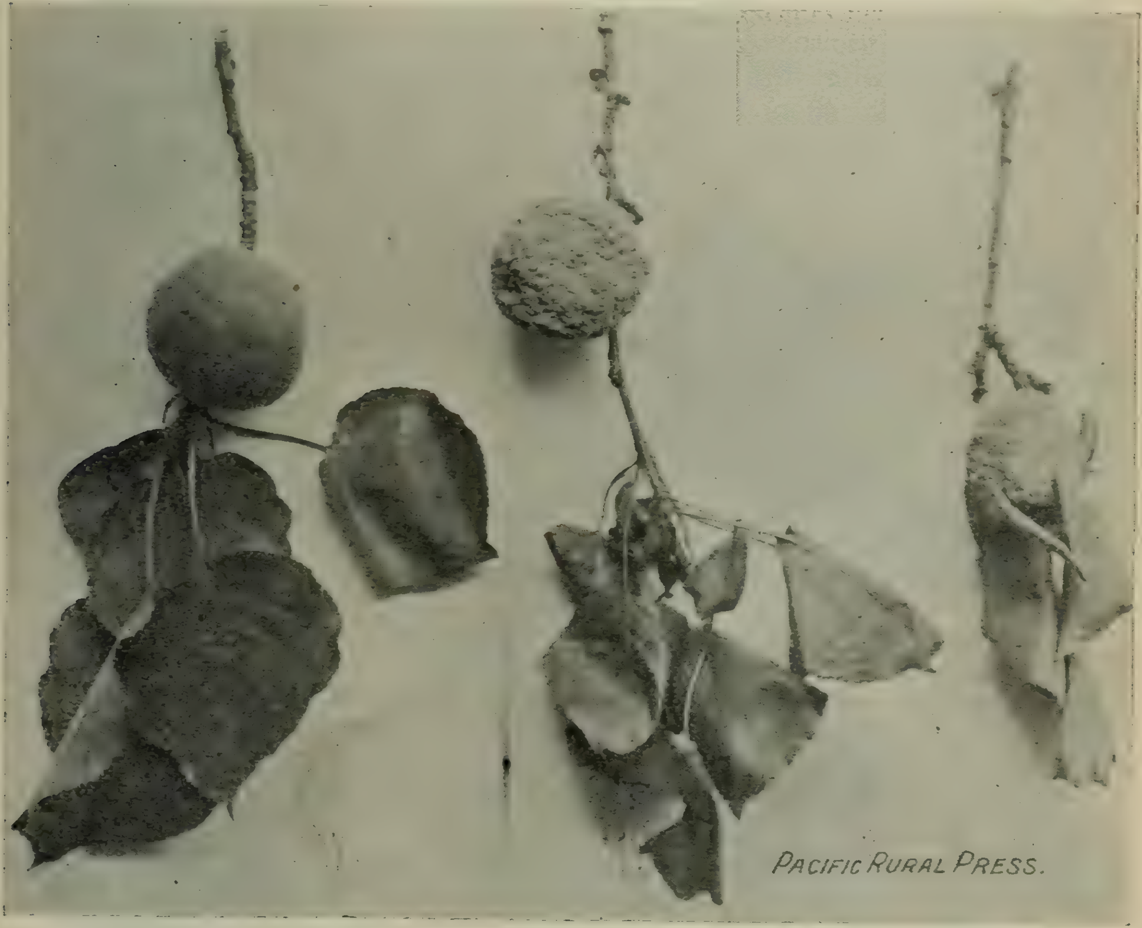
* Circular issued January, 1901.



Effect of Brown Rot on Fruit and Twigs of Apricots.

Brown Rot is caused by a mold or fungus called *Monilia fructigena*, which attacks various parts of the plant, leaves, blossoms, twigs, and fruit. Its effects are most evident upon the fruit, but it does an amount of damage that is hard to estimate, by attacking the other parts of the plant, but which some observers consider to be almost equal to that of the rotting of the fruit. The fruit is usually attacked after it has attained full size and just as it commences to soften. The first symptom in the case of apricots and peaches is a brown spot on one side of the fruit. This spot gradually enlarges and becomes covered with small ashy-gray pimples which consist of myriads of the spores of the fungus. Soon the whole fruit turns brown and the entire surface becomes covered with spores. The fungus then passes from the rotten fruit through its stem into the twig. Finally the disease attacks the twig so severely that it dries up, loses its leaves, and dies. The accompanying illustration shows apricots and twigs in various stages of the disease, and the gradual progress from the fruit to the twigs is well shown. In the fruit on the left, by looking closely it can be seen that the lower side is darker-colored than the upper, and that the light-colored spores have commenced to appear. The middle specimen is covered with a layer of the pimple-like masses of spores, and the leaves have commenced to wither; while in the specimen on the right the leaves are quite dead and the fungus has passed into the twig. The appearance of the disease on plums and prunes is somewhat different. In none of the specimens received at the Station were the spots formed when they arrived. The appearance of the diseased plums was not at first very different from that of the normal ones, but when they were cut open the inside was found to be discolored. When placed in a moist warm place, however, the spore masses developed in one or two days, and then the appearance was very similar to that of the diseased apricots.

The attacked fruit, instead of becoming soft and falling off, as with most other rots, gradually dries up and often remains firmly attached to the tree until the following spring. In spring a new crop of spores is produced by the mummified fruit, and, in the case of peaches, the young growth and blossoms are attacked. The same probably occurs in the case of apricots and other fruits. One of the worst features of this disease is that the fungus may be in apparently healthy fruit. Peaches which when picked and packed showed no sign of the rot, may be completely spoiled when the boxes are opened two or three days later.

Treatment.—As the fungus passes the winter principally upon the mummified fruit, the most effective method of combating the disease is to remove and destroy thoroughly all the diseased fruit. The diseased apricots should be gathered and destroyed as soon as the appearance of brown spots indicates that they are attacked, and not left on the tree until the fungus has penetrated the twigs. No fruit should be left on the surface of the ground. Any fruit which falls near the base of the trunk should be raked away in order that it may be buried by the plow. These measures alone, thoroughly applied, have been sufficient to produce a noticeable diminution in the amount of fruit attacked; but complete immunity can be obtained only by proper spraying in addition. All orchards where there is reason to suspect the presence of the rot, such as those where it appeared last year and those in their immediate neighborhood, should be sprayed with Bordeaux mixture one or two weeks before the blossoms open. This will prevent the infection of the blossoms, and in the case of peaches will also prevent curl-leaf. A winter wash with our ordinary lime-salt-sulfur mixture would doubtless be nearly as effective against the Brown Rot, and where used for destroying scale and other insects the first spraying with Bordeaux might be omitted. In any case, where the Brown Rot appeared last year the trees should be sprayed with Bordeaux as soon as the fruit has set. These measures will in most cases be sufficient with early fruit; but for late-ripening varieties, such as Moorpark apricots, a third spraying should be given about a week or ten days before the fruit commences to color. As Bordeaux would stain the fruit at this time it is better to use a spray of copper acetate.

Bordeaux mixture is a fungicide consisting of bluestone (copper sulfate), lime, and water, mixed in various proportions according to the season and to the kind of tree to be sprayed. For the first spraying, before the buds have started, the following formula can be recommended:

Copper sulfate	5 pounds
Quicklime	5 pounds
Water	45 gallons

For spraying the trees when in leaf it is better to use less sulfate and more lime, especially on peaches, in order to avoid danger of injuring the foliage. For the second and any of the subsequent sprayings the following should be used:

Copper sulfate	3 pounds
Quicklime	6 pounds
Water	45 gallons

Directions for Mixing.—1. Suspend the copper sulfate in a basket or perforated wooden box, in a barrel containing half the water. The box containing the sulfate should be just below the surface of the water, in order to dissolve quickly.

2. Slake the quicklime slowly and with great care, to insure a perfectly smooth paste free from grit. After the paste has stood for from twenty to forty minutes, with enough water to insure it from drying, dilute with the remainder of the water and strain through a wire sieve.

3. When the sulfate is dissolved and the milk of lime quite cool, stir each mixture well and pour them together into a suitable receptacle.

If large quantities of Bordeaux are needed it is more convenient to make up two stock solutions, as follows:

A.—Copper sulfate, 50 pounds; Water, 25 gallons.
B.—Quicklime, 50 pounds; Water, 25 gallons.

These should be made up in the way already described and separated until needed. For use take half a gallon of solution *A* for every pound of copper sulfate, and half a gallon of mixture *B* for every pound of lime wanted; dilute each separately with a little less than half the water; pour together and make up to the required volume with water, stirring thoroughly. Never mix the lime and copper liquids when hot.

The spray should be made as short a time as possible before using, and should be applied when the trees are dry and the weather calm. Only the best quality of quicklime should be used. The spray, for use when the fruit is large, is made by mixing six ounces of copper acetate (dibasic acetate of copper) with forty-five gallons of water. When the acetate is quite dissolved and mixed with the water it is ready to be applied.

MISCELLANEOUS REPORTS.

SALTBUSHES IN THE SOUTHERN COAST RANGE.

By C. H. Shinn.

Since the publication of Bulletin No. 125, three years ago, upon "Australian Saltbushes," two species of considerable promise have been received from South America, and several from Australia and South Africa, not before tried here. While these have been tested carefully and thoroughly, there have also been important developments in the culture of various species long on trial at the Central Station and the substations. Therefore it seems desirable to present this additional information as soon as possible, as the public interest in saltbushes, judging from the number of letters received, is rather increasing than diminishing.

The history of the introduction of Australian saltbushes in 1881, by the College of Agriculture of this University, has been told at some length in the bulletin just referred .to, and need not be repeated here. But it is worth while to note that now, after twenty years' experience, the saltbushes that appear worthy of cultivation in California are reduced to a very few species, several eliminations from the recommended list having occurred since 1898. The culture of the more promising species is steadily spreading, not only in California, but also in Arizona, New Mexico, Chihuahua, Sonora, and similar regions where there has been a marked increase of attention to the saltbushes in the pastoral districts.

Work Done by the California Station.—Turner's "Forage Plants of Australia" figures and describes, as of especial value, eleven species of Atriplex, five of Chenopodium, twelve of Kochia, four of Rhagodia, two of Scleolæna, and one of Enchylæna, or thirty-five species of Chenopodiaceæ, which are saltbushes and useful for pasturage. Other authorities, as Von Mueller and Maiden, have emphasized the value of some other species not in this list. Out of about forty species that seem to promise good results, the California station has made more or less trial of twenty, so that there is still much work to be done in completing this line of experimentation. But from among those species tested, several of great usefulness have been obtained, amply justifying the time and expense of these trials.

Atriplex semibaccata.—This famous Australian species, justly called the "half-berried saltbush," in allusion to its one-sided fruits, continues to attract deserved attention from farmers and stockmen. It is a prostrate or procumbent, slender perennial plant, whose stems spread from one to eight feet, according to the soil and climate. The success of the California station with this atriplex has led to renewed efforts on a large scale to increase its culture in its own country, and it now seems, according to reports in the Australian agricultural publications, that some very extensive re-stocking of native pastures is going on.

Four more seasons of trials of *A. semibaccata* have only served to emphasize its great value, if properly used. It is not a garden plant, nor will it thrive near the ocean; neither should it be planted on soil where alfalfa and the ordinary field crops are profitable. A native of the great alkaline plains of Australia, it succeeds best in regions of scanty rainfall and great summer heats. It possesses a remarkable range of soil adaptation within these limits, as it can now be found growing on the granitic sand and the slate soils of the Sierra foothills, in the heavy alkaline basins of the San Joaquin, and on strong clays and adobes. On the whole, it seems best suited for the more arid portion of the Coast Range and the great interior valley of California. In the Sierra foothills there are grasses and vetches which afford more nutriment.

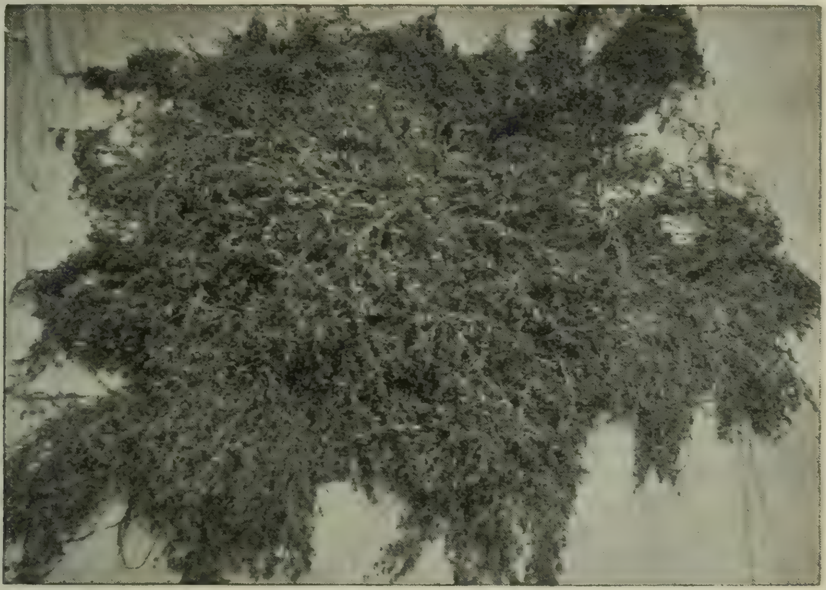


PLATE 5. AUSTRALIAN SALTBUSH—ATRIPLEX SEMIBACCATA.

Additional Evidence of Value of Atriplex semibaccata.—During the season of 1897–98, at the substation near Paso Robles, the total rainfall was only a trifle over four inches. The Australian saltbushes of this species, of different ages, including young plants sown in the autumn of 1897, received no irrigation nor cultivation, excepting that the weeds were removed from the youngest plantation in spring. The spring was very cold and dry, with strong northers. All field crops in the locality east of the Salinas failed completely. But the atriplex grew and flourished, and kept on growing all summer, one plot yielding at the rate of 500 pounds of seed per acre. (The high food value of the seeds constitutes one of the best features of the plant.) The same plot yielded in fodder at the rate of one and a half tons of hay per acre.

The management of saltbush hay requires care and considerable hand labor, as we have not yet found a machine to cut it. A sharp hoe or spade is very effective. It cures very fast,—in a few hours in such a climate,—and should be stacked and covered. It then "sweats out" and keeps quite moist and flexible. The crown of the roots should be left untouched, and if the second cutting be made late in September, late December forage can be had from the new growth.

The root-system of this atriplex has been illustrated and described in Bulletin No. 125, and in previous reports. Further observation confirms its great power of penetrating the "hardpan" of eastern San Luis Obispo and Monterey counties, owing to its habit of making very early growth.

Mr. Kerr's Testimony.—In the summer of 1900, Mr. John Kerr, one of the leading sheepmen of Cholame, reported as follows: "Sowed three pounds of seed on about two acres of gravelly land, March 15, 1900. The land was previously plowed and harrowed. Seed was sown broadcast. Got a full stand of plants, which grew about two feet during the summer. Had some also on adobe land, which did not do so well. I think that every one who has stock should have some of it sown, as it is good feed for all kinds of stock."

This is from the man who has done more with the saltbush than any one else in the region, and has used it to an increasing extent for four years. His evidence therefore should have especial weight.

Testimony of C. D. Guilford.—Mr. Guilford is a progressive farmer living near Creston. He makes three reports, all much to the point. Under date of November 29, 1900, he writes: "In regard to the saltbush seed I will say that on February 13, 1900, I sowed one pound of seed mixed with twenty-four pounds of dry sand, and got a good stand, except that the plants are small but in good health. From this lot I gathered two wheat-sacks of seed (about one of *clean* seed) and twenty-two sacks packed full of fodder, also two sacks of seed and dirt gathered with a broom and dustpan. One sack of this I sowed to-day. I will sow at intervals during the season. I sowed one quarter of a pound to twelve pounds of sand, but found it was too much sand."

On December 18th he wrote: "I received your letter yesterday, and in reply will say that I sowed one pound of saltbush seed mixed with twenty-four of dry sand; therefore, I expect to have one acre of plants. My cows eat it greedily, dry and green. After being cut and piled about five feet deep in the shade for nearly a month without being turned, the bottom of the pile was green and fresh as if just cut. Hens would scratch the ground the cows were fed on for the seed. The land was deep clay soil, with light clay subsoil and sloped to the east. I am going to sow about four acres adjoining, so as to have it ready for a flock of hens this coming fall, as I find my hens will not let it come up if they can get to it."

May 6, 1901, he wrote again: "In regard to the saltbush, I would like to say that I think it will be hard to beat. My cows eat it greedily, green or dry; also hogs. Hens eat the seed. Saltbush now one year old, that was cut for hay last fall, has now a new growth of fourteen to sixteen inches among a heavy growth of grass and weeds, but I know from experience that the weeds will die in summer, and the saltbush will flourish. The new plot is growing finely. Plants are as large as dinner-plates; whereas the plants sown last year were, at this time of the year, only six inches across. In short, I am going to seed all of my spare land, good or bad, as fast as I get it cleared, to saltbush. I find it a good feed for milch-cows. A part of my new plot is on high, granite soil, about six inches to rock, and I think it will tell the tale as to drought."

Experience of 1900 at the Substation.—The foreman, Mr. Barber, reported under date of January 9, 1901, as follows: "Our oldest large plot (sown December, 1897) yielded, on one sixth of an acre, 1060 pounds of hay (*dry* fodder), being at the rate of 3⅓ tons per acre. This piece in 1898, its first season, yielded about 1½ tons per acre. New plants do not make much growth until the warm weather sets in; but old plants, cut or pastured back, on the contrary make a good growth during the winter, their feeding roots being below the reach of surface frosts. Of course they do not grow as fast as in warm weather, but nevertheless make a good deal of early feed, more than any native grasses I have seen about here. Saltbush cut back close about October 15, 1900, has six to eight inches of new growth at this time (January 9th); alfilaria (*Erodium cicutarium*) on the same soil has grown two to three inches. This is on the sandy soil with hardpan."

Powers of Naturalization.—The only one of all the various saltbushes tested by the Station which shows a tendency to "run wild" and take care of itself is *A. semibaccata*. During drives extending over about one hundred square miles around the substation (Paso Robles) we visited a number of places where the plant had been sown and neglected, but was, as a rule, spreading out. If unpastured, it yields to "foxtail," but so do all our valuable native forage plants. If pastured in spring, the setback given to the foxtail saves the saltbush. Another enemy, and particularly in dry years, is the ground-squirrel. This little animal is very fond of saltbush, and so are hares and rabbits. Birds like the seed, but possibly aid in disseminating it.

Self-sown plants examined by the roadsides, spread along the harder portions and avoid foxtail-covered areas. The seed sown on two acres of very poor gravel in a gulch, and left without protection, came up and grew well for some months, but squirrels, rabbits, and birds destroyed it all, so that two years later no plants remained in the field. A few plants were found by me, on a later visit, on the opposite hillside, and a few in the gulch.

Frost Endurance.—*A. semibaccata* has been injured severely by a temperature (January 1, 1901) of 12° Fahr. The crowns were not hurt, but the young growth was nearly destroyed. The March and April frosts are much less injurious. Young plants a few weeks old have been killed by 17° Fahr. The conditions of growth vary much in different localities. Under natural pasturage, the old growth greatly protects the new, and plants naturalized by the roadside among weeds and grass did not suffer at all.

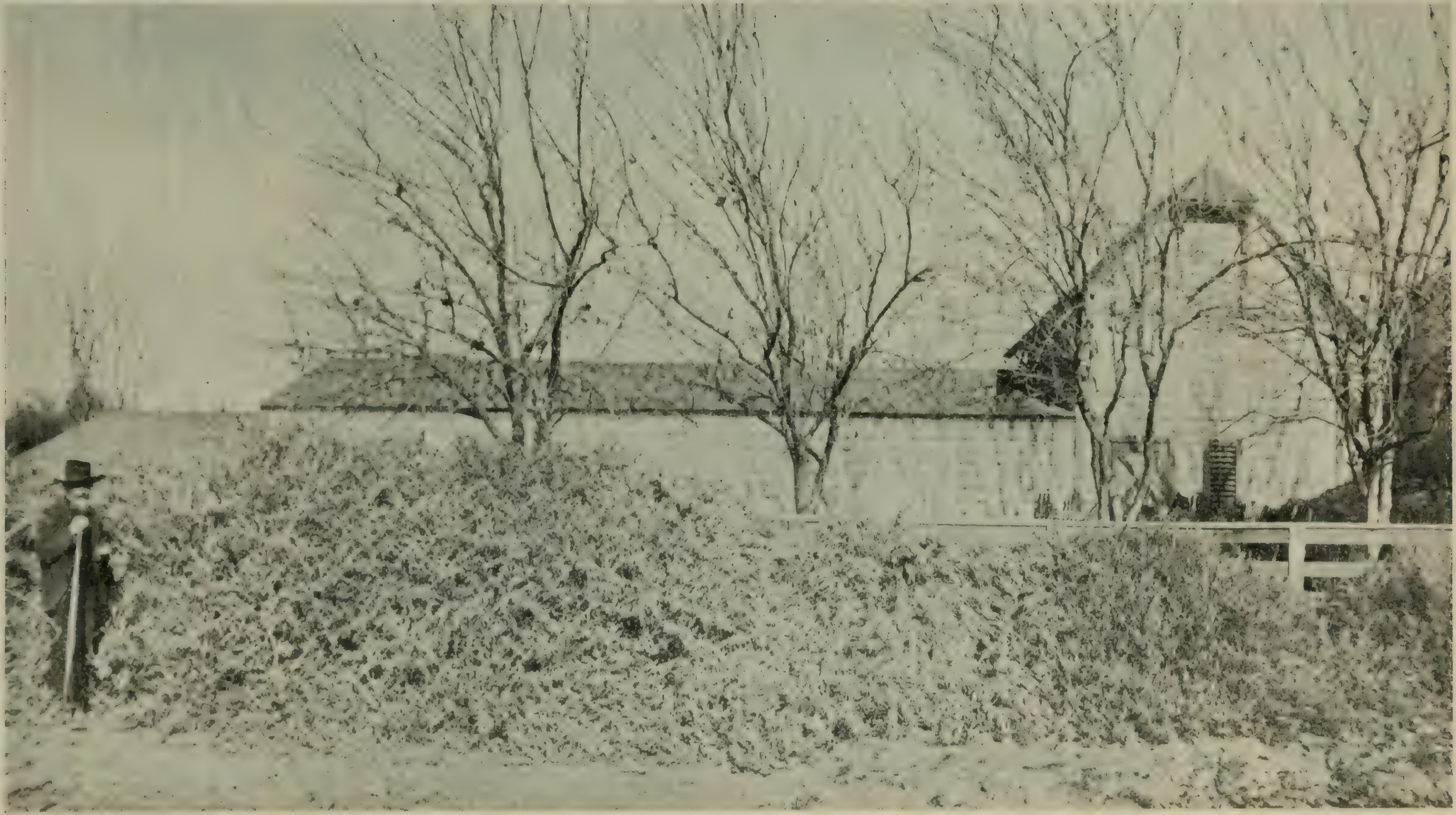
Other Saltbushes.—The experience of the Paso Robles substation with other saltbushes has been very gratifying. The following notes were taken on the ground during the seasons of 1900 and 1901. The species to which especial attention is called are *A. nummularia*, the "Old Man saltbush" of J. H. Maiden; *A. pamparum* and *A. cachiyuyum*, sent to the California station by President Rocca, of Argentina; *Rhagodia nutans* and *R. spinescens inermis. Atriplex leptocarpa* has no advantages over *A. semibaccata* for this region; *A. vesicaria* and *A. halimoides* do not yield well when old plants, and are apt to die out in spots.

A. nummularia, grown from cuttings, received no irrigation, made plants several feet high, and covered the ground well. Cut December 11, 1901, it yielded at the rate of 17 tons 485 pounds of excellent green forage for cows and sheep. This species stands two cuttings a year, here, yielding a total of not less than twenty tons of green feed. If cut but once, the branches are more woody and waste occurs. This species now seems the most promising of the large saltbushes for this region. At present, however, no fertile seed can be had, and growth from cuttings offers the only method of propagation.

Superior to A. halimoides and A. halimus.—Under all circumstances where tested, at the Central Station and at the substations, the yield of *A. nummularia* is much greater than that of *A. halimoides*, the largest of the other Australian shrubby species grown in California. Only one plant of *A. halimus*, a South African species of local repute, has been grown, the seed proving poor, and this yielded to drought. The Agricultural Journal of the Cape of Good Hope, May, 1893, reported at length upon comparative trials of *A. halimus*, their native species, and *A. nummularia*, with the conclusion that the last-named yielded more and better forage. The Agricultural Gazette of New South Wales urges all landowners to establish "small, enclosed plantations" of this saltbush for a stand-by in years of scant rainfall.

PLATE 6. ATRIPLEX NUMMULARIA.

How to Propagate from Cuttings.—In Australia the cutting system of propagating this saltbush is preferred to any other. Medium-sized pieces of wood from six inches to a foot long are used, and the cuttings are set out in rows four feet apart and two feet in the row, in warm, showery weather. In California, while cuttings were originally rooted under glass, it is found that they root easily in boxes of sand without any bottom heat. They need not be more than six inches long. Both the young and the old wood will strike root, but old wood seems better. Early planting with the first rains in boxes, and moving to the field when the spring weather is warm, should succeed. Five- and ten-acre fields have been established by means of the cutting system in Australia,



Atriplex pamparum.

PLATE 7. SALTBUSHES AT TULARE SUBSTATION.

Atriplex cachiyuyum.

and found to pay well for the trouble. At the Wagga Wagga experiment farm, New South Wales, the plants were set four feet apart each way. This distance will do on rich soil in California, but on the poorer soils of the Coast Range, under consideration in this paper, they do not cover the surface, and four by two, or even two by three feet, would be better. Fifty plants a year old will yield enough cuttings to plant an acre of ground. On rich land, twenty-five plants will be sufficient.

Atriplex nummularia was grown from seed at the Central Station in 1882, and plants were distributed. None of them yielded fertile seed, and so were not propagated from. The original plants at Berkeley still stand, and have furnished many cuttings. The plants at the Paso Robles substation are now furnishing cuttings to local applicants. It seems evident that the Australians consider this one of the best, most fattening, and most wholesome of their saltbushes, and have settled down upon propagation by cuttings as entirely practicable. The discovery since 1899 that this atriplex is more nearly drought-resisting than any other forage plant yet tested at the Paso Robles substation, marks it as a most promising species for the southern Coast Range, and renders its more extensive propagation advisable.

Atriplex pamparum and *A. cachiyuyum* are two tall-growing saltbushes (Plate 7), the seed of which was received from Argentina in 1899. These species much resemble each other in appearance and growth, but are different in bloom. The former yields best, so far as tested, at both the Paso Robles and the Tulare substations. They differ much in appearance from the Australian and South African species. They are more slender, and with drooping ends of branches which often touch the ground. Much less brittle, they need closer browsing to keep the young growth tender. Deep-rooting, they withstand drought, and they have not been touched by frosts.

The large plot of *A. pamparum*, cut and weighed December 11, 1901, yielded at the rate of 15 tons 628 pounds per acre. *A. cachiyuyum* yielded at the rate of 12 tons 269 pounds per acre. Two cuttings a year are practicable with these saltbushes, or browsing at more frequent intervals.

These two species seem to have been introduced into the United States by the California station. They promise to become useful in the more arid districts. They will root from cuttings, but seed offers the best way to propagate them. As yet, however, no seeds have been produced in California. The plants at the Tulare substation grew eight and ten feet high; at Paso Robles, about half as much.

Rhagodia spinescens inermis. — This large and useful shrub (Plate 8) thrives wherever it has been planted in the interior of the State, as well as in the Coast Range. It contains less salt than the atriplexes do and is more readily eaten by horses. It grows easily from seed and cuttings. Its drought-resistant powers are very great, and it will justify trial on a larger scale than heretofore.

In actual yield at the Paso Robles Station, this rhagodia falls a little below *Atriplex pamparum*, giving at a December (1901) cutting 14½ tons. Two annual cuttings give larger and better returns. The branches are less brittle than those of the atriplexes.

Rhagodia nutans.—This trailing perennial herb makes a very poor appearance beside the tall saltbushes, and it yields much less to the acre at Tulare than does *Atriplex semibaccata.* Still, on the "hardpan" of the Paso Robles substation it fills a very useful place, yielding at the rate of nearly 11 tons per acre, in which there is no waste. The hardiness and drought-resistance of this handsome, little red-berried creeper are also remarkable. It therefore justifies more extended trials. It seems to be a most valuable plant for this district, but not for the San Joaquin.

PLATE 8. RHAGODIA SPINESCENS INERMIS.

Species Difficult to Introduce.—The continuance of efforts to obtain those species recommended by authorities elsewhere, but germinable seed of which has not yet reached this Station, is thus amply justified. These desired species are chiefly Australian, which are described in Professor F. Turner's "Forage Plants of Australia," published by the Department of Agriculture of New South Wales. They include the following:

Coastal Saltbush (*Rhagodia billardieri*) is a shrub reaching the height of six feet. It has great value as a forage plant and as a sand-binder. Our California experience with the rhagodias shows that horses are more fond of them as fodder than of the more salty atriplexes. The species above named endures a large amount of common salt in the soil. Its resistance to alkali is probably less than that of the atriplex. It is naturally a plant for the sand-dunes of the coast.

The "Old Man Saltbush" of Turner (*Rhagodia parabolica*) has been sent to the California station on three occasions: in 1898, 1899, and 1900; but the seed has failed to germinate, being infertile. Several California seedsmen have sold, under the name "Old Man Saltbush," other and less valuable species than *R. parabolica.* The term seems to have been applied to three or four widely differing plants; a striking illustration of the necessity of adhering to the scientific name and description. This useful shrub (*R. parabolica*), which grows from five to ten feet high, is much preferred by cattle. It is not one of the most drought-enduring species.

At the Wagga Wagga experiment farm, there were in 1897 five acres of *Rhagodia parabolica* used to grow cuttings for distribution (Agricultural Gazette of New South Wales, for October, 1897). Cuttings of old wood are recommended, planted in rows eight feet apart. Soft-wood cuttings are said to require rooting under glass. On the whole, according to this journal, this rhagodia "yields the largest amount of nutritious fodder, grows most rapidly, and is the most easily propagated. Nevertheless, in recent years the success of *Atriplex semibaccata* in California has caused the Australians to plant that species also on an increasing scale."

The Halbert-leaved Saltbush (*Rhagodia hastata*) is a spreading undershrub which varies in height from two to five feet. Seed of this also has been obtained on several occasions, but proved worthless. It is a plant which thrives in a hot, dry climate, and all kinds of livestock, particularly horses and cattle, thrive upon it and are fond of the forage.

The branching goosefoot (*Chenopodium nitrariacea*) differs much in appearance from both rhagodias and atriplexes, but it is one of the important salinous plants of the interior of Australia. It forms a much-branched shrub of from three to eight feet high, and it furnishes a valuable browse for livestock, making much fresh growth. Another valuable chenopodium is the noted "Blue Bush," a perennial plant of three to five feet high, native of central Australia, and greatly liked by all kinds of livestock. The perennial small-leaved goosefoot (*C. microphyllum*) is noted for sheep pasture. *Chenopodium atriplicium* is another perennial growing a foot high and enduring severe drought. All of these chenopodiums, together with some annual species, have illustrated, at various times in the past ten years, the difficulty of obtaining fertile seeds from abroad. No dealers carry this kind of stock, and collectors secure it only at long intervals.

Of the thirty species of Australian atriplexes, few of promise remain to be tested in California. *Atriplex stipitata*, the "kidney-fruited saltbush," is now becoming very scarce in Australia, by reason of overpasturage. It is a very fine forage shrub. Seeds sent here were infertile. It may be said in passing that many saltbushes are diœcious (bearing male and female flowers on different plants), and that infertile seed is often sent out by careless or ignorant collectors.

The gray saltbush (*Atriplex cinerea*), a branching shrub several feet high, is one of the very best of the çoast species. It also grows readily from cuttings, but the seed has hitherto proved worthless.

PRACTICAL FEEDING TESTS.

It is still said by many farmers that the saltbushes will not be eaten by livestock. Respecting this, the Journal of Agriculture and Industry of South Australia recently said: "We have from time to time published a considerable amount of information concerning the attention paid to Australian saltbushes in California and South Africa. Now it is being claimed that neither horses nor cattle will eat *Atriplex semibaccata.* This is the first time this plant has been the recipient of such sweeping condemnation. It is with this as with other valuable forage plants. It is not unusual for stock to refuse to eat it until they become used to the taste."

This is a sensible way to put it, and the experience of the past two years shows conclusively that sheep universally take to *Atriplex semibaccata*, and that cattle, on dairy ranches where it is grown, are more and more fond of it. We can not learn that it has been fed to horses to any extent.

A series of feeding experiments with the other species of saltbushes recommended at the Paso Robles substation show the following results:

Atriplex nummularia, fed when first cut, was well liked by sheep, and fairly by cows, but only browsed over by horses. When half-cured in the sun, the cows and sheep were very fond of it, but the horses did not eat it. *Atriplex pamparum*, when fed green, was better liked by cows and sheep than when wilted, but the reverse proved the case with *A. cachiyuyum.* Horses ate but lightly of either. *Rhagodia spinescens inermis* was decidedly better fed green to horses, cattle, and sheep, all of which ate freely. *Rhagodia nutans* fed equally well green and wilted to sheep and cattle, but horses ate little. There was no opportunity to try these fodders on range horses accustomed to rough conditions. As a fact, the Australian stock-raisers use all the saltbushes, and they have been nearly destroyed in their native districts by over-pasturage.

WHERE TO PLANT SALTBUSHES.

In more than fifty cases we have been shown plots or fields of *Atriplex semibaccata*, *A. leptocarpa*, *A. vesicaria*, or *A. halimoides* which were sown on too rich and moist soil for these desert-loving plants, which are not designed by nature to struggle for life against tall alfalfa, bur-clover, or alfilaria. In such locations, the only value of the saltbushes is to add variety to the pasture.

The saltbushes, as all observations agree, thrive more or less on poor soils under hard conditions, or on soils strongly impregnated with "alkali." They thus naturally divide continually into two classes: those which are best adapted to poor, dry soils, and those which do best on the deep "alkali" soils; but species have done well in both situations. We have not yet obtained the best species of coastal saltbushes, but *A. leptocarpa* has shown some adaptation to the ocean shores.

Within the above limits, there are very large areas in the Coast Range which it seems probable from the experience herein detailed will yield more forage in saltbushes than in any other crop. The establishment of such forage plants, on poor soils, in a region of light rains, is always difficult, though not impossible. But they will hardly grow on soil so poor or so rocky that no vegetation appears there. At the desert, even saltbushes cease their advance.

HOW TO SUCCEED WITH SALTBUSHES.

Having experimented on a small scale, and thus ascertained that the location is fit for the saltbush, let the farmer fence in a larger piece and extend his operations, either by seeds or by cuttings. All the saltbushes are healthy and unusually free from insects or diseases, but all are very subject to attacks by small animals. Since the farms in the rough foothill regions, where inclosures of saltbush would be of most value, are often surrounded by much waste land, the losses incurred are very great. The value of wire netting, used to surround a small field until its crop is well established, is evident. Without this, saltbushes must often be planted near the house to protect them.

Saltbushes, if unpastured, can be choked out in wet seasons by foxtail, as mentioned before. Drilling or planting in rows, and one season's cultivation, are advisable, especially with spring-sown seed.

The Tall and Trailing Saltbushes Compared.—The low forms of saltbush offer advantages over the bushy species. Their growth has less woody material and waste; they also stand pasturage better in most cases. The only danger to guard against is the eating of the crown or center of the root by sheep or cattle, which is fatal to the plant.

The tall-growing species are well adapted to rough land, make more forage (also more waste), are in most cases entirely trampled down and destroyed, and therefore seem to require cutting by hand to produce to their fullest extent. This, however, is regularly done in Australia, and there is no reason why it should not be done here in many cases, and to an increasing extent.

The Best Tall Species.—The tall saltbushes named in this paper are all promising species, and their probable value justifies extended trial by farmers, subject to the conditions before noted. *A. nummularia* appears to have a greater usefulness than was formerly supposed; *A. pamparum* deserves further tests, and *Rhagodia spinescens inermis* has grown very well indeed in the Sierra foothills as well as in the Coast Range. These shrubs, there seems no reason to doubt, may be made to take the place of some of our native "scrub" which affords no food to livestock.

Value of Saltbushes on Light Soils.—The observations which appear in this paper have all been confined to light and arid soils, free from alkali. On the whole, the conclusions even here are favorable. After *Atriplex semibaccata* had been grown three years on such soil at the substation its growth was materially checked and it nearly ceased to form seed, but the next season it recovered in great measure, while young plants on a portion of the same plot grew with great vigor, thus showing that the lack of salts in this soil was not as injurious to the growth of the plant as it had been feared would be the case. A field of this saltbush (Mr. Guy Heaton's), in the Coast Range west of Paso Robles, failed to produce seed after several years of strong growth. This was found to be due to the blighting of the blossoms and not to any exhaustion of the salts in the soil. It has several times happened, even at Tulare, where the soil is so strongly impregnated with alkali, that the blossoms have blighted under dry north winds, and have set no fruit.

All of the saltbushes on the light and dry soils under consideration reach a much smaller size than they do on stronger soils. Approximately, the single plant, whether atriplex or rhagodia, of any of the species named in this paper, will cover an area or attain a total weight in a given time of not more than one fourth of that which it would have at the Tulare substation on the alkali soil. Hence closer planting becomes necessary, and the exhaustion of the lighter soils is appreciably nearer. The saltbushes have grown well, keeping green all summer on "hardpan" soil upon which deciduous fruit trees had previously made a complete failure.

COMPOSITION AND FOOD-VALUES.

In Bulletin No. 125, Professor M. E. Jaffa discussed at length with great care the composition and food-values of the saltbushes which had to that time been grown at the substation. The following analyses of *A. semibaccata* and *A. nummularia* are copied from that bulletin, and those of *A. pamparum* were made by Professor Jaffa and Mr. C. A. Triebel from the crop of 1901, grown at Tulare:

TABLE SHOWING THE COMPOSITION OF DIFFERENT SALTBUSHES.

	Moisture.	Pure Ash.	Crude Protein.	Crude Fiber.	Nitrogen-Free Ext.	Crude Fat.
Atriplex semibaccata	75.00	4.93	3.93	5.58	10.15	.41
Atriplex pamparum	71.79	5.86	5.57	6.28	9.82	.68
Atriplex nummularia	75.00	7.82	4.11	1.81	10.71	.55

It appears from these analyses that the food-value of *A. pamparum* does not materially differ from that of the Australian saltbushes. As this bulletin has previously shown that this species is very drought-resistant, and is of easy culture, its more general use is much to be desired. *A. cachiyuyum* under analysis shows rather less of food-value, nor does it grow quite as well as *A. pamparum*, hence as far as tested it is of minor importance.

REPORTS ON PLANTS RECEIVED FOR IDENTIFICATION AND OPINION AS TO THEIR ECONOMIC VALUE.

By JOSEPH BURTT DAVY.

JULY 1, 1898, to JUNE 30, 1899.

Alderman, W. J.; Grass Valley, Nevada County.—Ceanothus integerrimus, a native shrub of the Sierra Nevada. Mr. Alderman reports that stock are fond of browsing on it. In Calaveras County it is called "Deer-brush," as deer are said to browse on it extensively.
Oakleaf gall on Quercus lobata.

Bailey, Miss L.; San Francisco.—Sparaxis tricolor, "Garibaldi," and Ixia paniculata, both of South Africa.

Barber, J. H.; Santa Monica, Los Angeles County.—Angophora lanceolata, a Myrtaceous tree of Australia, closely related to the Eucalypts; a valuable tree for avenues.

Bayley, George H.; Likely, Modoc County.—A grass indeterminable, because no flowers or fruit are present and the leaves are only rudimentary. Inquires whether it will keep sheep fat. There are 50,000 acres covered with it in Modoc County.

Berry, C. P.; Wheatland, Yuba County.—Zizyphus vulgaris, "Syrian Jujube," native of Asia Minor; the fruits are extensively used in the south of France and in Italy for various forms of preserve, for fruit-syrups, pies, etc. Specimens sent were from a shrub about ten feet high and twelve years old, which had been fruiting three or four years.

Childs, Mrs. R. C.; San Luis Obispo.—Fiber of a local plant, probably a species of Milkweed (Asclepias). We need leaves and flowers in order to made a determination, and about four pounds of fiber for a commercial test.

Cunningham, James F.; Mountain View, Santa Clara County.—Asclepias fascicularis, "Narrow-leaved Milk-weed," said to have poisoned many cattle.

Dewey, L. H.; U. S. Department of Agriculture; Washington, D. C.—Inquiry as to the distribution of Picris echioides, a European weed, in California. This plant is a weed from Europe; "during the last two years seeds of this species have been observed in some of the field seeds in the Eastern States, especially those which have been imported." Reported by Dr. E. L. Greene as becoming very abundant in Vallejo (see Botanical Gazette, 1882). It is now very common in the Santa Clara Valley at College Park, near Santa Clara, where we first noticed it in 1895. It has been steadily on the increase around Berkeley during the last two years, but in neither locality has it shown indications of becoming a really troublesome weed.

Donkin, G. F.; Grayson, Stanislaus County.—"Shrubby Aster" (Gutierrezia cuthamiæ).

Dutard, H.; San Francisco.—Myoporum lætum, an ornamental evergreen shade and sand-binding tree, from Australia.

Distichlis spicata, an "alkali weed," useful for binding levees.

Frankenia grandifolia (Alkali Heath), from Santa Barbara County; reports that horses eat it readily. It appears useless for general forage purposes.

Edwards, E. A.; Hollister, San Benito County.—Atriplex torreyi, S. Wats., a native saltbush. A tall shrub, often eight to ten feet high. "I notice my cow browses on it considerable."

Erlanger & Galinger; San Francisco.—Seeds of Dodder (Cuscuta trifolii).

Fairweather, J.; Reedley, Fresno County.—Samples of plants, of which seed was bought as "German Millet." No. 1, German Millet (Chætochloa (Setaria) italica); No. 2, Indian Millet (Panicum miliaceum).

Fowler, D. T.; Oakland, Alameda County.—Eucalyptus of low-growing habit, which makes a hedge, never high and always branching, frequently from a low start. It makes many shoots, thickening as they rise, making dense growth of foliage. Only a form of E. globulus, the Blue Gum, which even in Australia is sometimes found dwarfed and flowering at only ten feet high. This is the first record for California which has come to our notice, and we are unable to explain the cause of this change of habit. It would be interesting to propagate it from seed, in order to determine whether it will maintain this habit.

Franceschi, Dr. F.; Santa Barbara.—"Balsamea," Zauschneria californica, affected by a gall insect.

Twenty-one specimens of Australian Acacia.

Frost, B. A.; Arcata, Humboldt County.—Timothy (Phleum pratense, L.).

Gerber, P.; De Forest, Santa Clara County.—Eriogonum vimineum, a plant belonging to the Buckwheat family (Polygonaceæ). It is a native of California, not at all uncommon in the Bay region, which is its home. It may have been introduced into the De Forest district, as Mr. Gerber suggests, but it is probably indigenous there and some especially favorable conditions may have prevailed, causing a more abundant and luxuriant growth than usual. It seems to prefer dry soils.

Guilford, C. D.; Creston, San Luis Obispo County.—No. 4, Ailantus glandulosa, "Tree of Heaven," from China; No. 3, Hakea sp., from Australia; we need flowers in order to name the species; No. 1, Acacia calamifolia, from Australia; "half hardy, but gets killed about New Year"; the "Broom-Wattle," a valuable tanbark tree; No. 2, Acacia mollissima, "Silver Wattle," a valuable tanbark tree of Australia. "Nos. 2 and 3 are hardy and stand 16° above zero, as low as it gets here." The Acacias and Hakea grew four feet in two years, without water; south exposure and clay soil. Wood of No. 4 valuable for joiners' work, being extremely durable, pale-yellow, and of silky lustre when planed; it is tougher than that of oak or elm, easily worked and not liable to split or warp.

Hall, H. M.; Berkeley, Alameda County.—Lavandula latifolia, C. Bauh. (L. spica, DC.); asks if this is the best lavender for cultural purposes in southern California. This species yields a larger percentage of oil than L. angustifolia (L. vera of some writers), and the odor is stronger, but it is said to be less agreeable. L. latifolia is the species from which most of the south European essence is obtained; while L. angustifolia yields the English oil.

Hammond, R. G.; Lockeford, San Joaquin County.—Heliotropium curassavicum, a troublesome alkali-weed; "beats morning-glory in rapid growth," and continues to come up after being hoed off, unless the cutting is repeated many times.

Heathman, D. F.; Santa Ana, Orange County.—Fiber of Agave americana; asks for information as to its relative value: "There are a great many people in this vicinity who are considering the cultivation of the Century Plant for its fiber." He adds: "When I was beating the leaf to extract the fiber, the juice of the leaf spattered my face and severely blistered it. By means of neutral litmus paper I found that it was acid. I would be glad if you would make experiments to determine what kind of acid or poison is contained in the leaf." Referred to U. S. Department of Agriculture, Fiber Investigations; Report No. 5, 1893, pp. 34–37, where the subject is given full discussion. Mr. V. K. Chesnut, of Washington, D. C., to whom the question of the acridity of juice was referred, writes that after looking up the most promising literature he finds nothing more satisfactory than the information given in the U. S. Dispensatory (1896): It is claimed that the juice of this plant is not sweet and is not the source of pulque, but that, on the contrary, it is acrid and reddens litmus, and that, when evaporated (with loss of acridity perhaps), is used as a substitute for soap.

Henry, J. H.; San José, Santa Clara County.—Seeds of Bronco-grass (Bromus maximus gussoni).

Hickman, J. B.; Monterey, Monterey County.—Albizzia lophantha, ornamental shrub, native of Australia, and valued as a sand-binder.

Hobbs, E. M.; Shasta County.—Ptelea crenulata, "Hop Tree."

Howe, Mrs. H.; Berkeley, Alameda County.—Bronco-grass (Bromus maximus gussoni).

Hoyle, E. Petrie; San Francisco.—Larrea mexicana. This plant is known as "Hideondo" or "Gobernadora" by the Mexicans, and as "Creosote-bush" by whites. It has various reputed medicinal properties; said to be a wonderful remedy in cases of necrosed and ulcerating bones; also as good in cases of syphilis; but method of application is not stated in either case. The leaves are sticky with a strongly scented resin, and burn with a black smoke and rank odor. Miners say that a strong decoction "will clean amalgam." It is said that the Indians formerly made a glue from it, with which they fastened their arrowheads to the shafts. The Kokopah Indians use a decoction as a blood medicine.

Josephi, D. E.; Bakersfield, Kern County.—Scrappy specimens from sandy soils of the "Weedpatch": Salvia carduacea, Mentzelia affinis(?), Amsinckia sp., Festuca microstachys, Eriogonum angulosum (?), Lotus sp., Malacothrix sp., and Caulanthus sp. (?).

Kasson, M. C.; Crystal, Oregon.—Hordeum nodosum, "Northern Wild Barley."

Kavanagh, George W.; Haywards, Alameda County.—Corn smut fungus (Ustilago zeæ (Beckm.), Unger.) on corn (Zea mays). A well-known disease of corn, related to the smut of wheat. It is found that corn smut is produced wherever infection occurs, and that this may be in any young growing portion of the corn plant, where spores fall upon it. More smut is found in dry seasons than in wet ones, and in dry situations than in wet ones. Manured land is said to produce more diseased corn than unmanured, the manure (or any decaying vegetable matter) forming a propagating bed for the fungous spores, the secondary spores so produced being as injurious as the first. Proximity to barnyards and the like will have the same result as manuring the land. It is not probable that treatment of seed-corn with bluestone will be effective. To heat the seed-corn appears to have no beneficial effect. To avoid conditions favorable to the spread of the smut will sometimes be possible. Freshly manured land affords the proper nidus for the yeast spores of the smut. We can not, from present knowledge, prevent the smut, except possibly by some method that is more expensive than the losses from smut justify. Thorough spraying with fungicides would probably prevent most of the smut, but the cost of such treatment precludes its use. The most promising method, especially upon highly manured lands such as are planted to sweet corn, etc., is to cut out and burn the smutboils before they are ruptured. This practice could, of course, have but little immediate effect; its usefulness will lie in reducing the liability of infection to the succeeding corn crop. To carry the infected plants away for fodder is a sure method of propagating the disease, as the spores are thus mixed with the manure, where they flourish and multiply, producing secondary spores, which are as injurious as the primary spores. (Ohio Agric. Expt. St. Bull. 8, April, 1897.)

Lauriault, Aquiles W.; Tapona, Durango, Mexico.—Albizzia lophantha of West Australia.

Lloyd, Julius S.; Sheep Ranch, Calaveras County.—Dakota Vetch or California Lotus (Lotus americanus). "In a hilly basin, at an altitude of 2,000 feet, this plant flourishes. It makes its appearance when all other grasses are dried up, and reaches a height of three feet without irrigation and on dry land. I do not know that irrigation helps it, or that horses like it green. Cattle and hogs seem to prefer it to other green grass. Cows feed on it and give excellent milk. About the time grain is cut this grass appears and grows and keeps green till winter. I have called it a pea, but a stockman tells me it is 'Spanish Clover' and a very rich food. Young calves eat the tops. It is said to make good hay. You can see that it has considerable seed. It will cover the ground."

Logay, J. J.; Los Gatos, Santa Clara County.—Leaf of a leguminous shrub or small tree allied to Sophora. Material too imperfect to name. Suggests that Blood-root (Sanguinaria) "would succeed well" in California. This plant was tried at Berkeley some years ago, but died out the second year.

McLaren, John; Superintendent Golden Gate Park, San Francisco.—Fourteen species of Acacia.

Meissner, E. F.; Kirby, Oregon.—Information concerning the Flat Pea (Lathyrus sylvestris wagneri).

Olschowka, Arthur; Dunnigan, Yolo County.—Specimen of Barley which came up in place of White Oats bought in Carson City, Nevada, in the fall of 1898; not an oats head is to be seen among the rest. Seed probably badly mixed and the conditions proved more suitable for the germination of Barley than of Oats.

Rivers, J. J.; Santa Monica, Los Angeles County.—Abronia umbellata from the sand hills, Santa Monica; reported as the probable host of the parasitic Pholisma.

Rock, Mrs. A.; Malacate, Sultepec, State of Mexico, Mexico.—Specimen of Clematis pauciflora (?).

Sievers, F.; Lomitas, Napa County.—Razoumofskya douglasii abietina, a parasite on the Digger Pine.

Sing, Otto; San Francisco.—An Iochroma, not in flower, probably I. lanceolata, an ornamental shrub from South America.

Smith, E. M.; Kenwood, Napa County—Broomcorn Millet (Panicum miliaceum). "In favorable ground will grow three or four feet high; horses refuse to touch it, but cows I have fed it to eat it as readily as grass or hay, and it stimulates a marked increase in the flow of milk. I planted it in June on foothill land, and cut the crop about the first of August, and since then the roots are sending out a lot of short seed stalks, which is quite remarkable, considering the very dry season."

Under date of December 3, 1898, Mr. Smith writes: "A still further experience with it only serves to convince me more fully of its value as cattle feed, and a great milk-producer. The seed is hard to start, as it requires plenty of moisture to sprout it, and the young plants are very sensitive to frost."

Stivers, H. F.; Rosewood, Tehama County.—Croton setigerum (Benth.), "Turkey weed."

Fritillaria pluriflora, Zygadenus speciosus, Brodiæa laxa, and Pedicularis densiflora (Lousewort), all from Rosewood, and Brodiæa capitata, for name.

Suhren, George H.; Collinsville, Solano County.—Xylothermia montana, a native chaparral, from Rockville, Solano County.

Twitchen, George; St. Helena, Napa County.—Santolina chamæcyparissus incana and Antennaria tomentosa (?), two garden plants.

Weilheimer, A.; Santa Maria, Santa Barbara County.—Seeds of Saponaria vaccaria, a very bad weed in some parts of the West. The seeds were found among "seed barley raised in Oregon."

Miscellaneous Plants Sent In.—Vinca major.—Amarantus retroflexus, reported to be killing horses which eat the seeding panicle; the bracts, etc., forming a stoppage of the bowels.—Rhagodia spinescens inermis.—Inquiry into the use of Melococca bijuga.—Peumus boldus and Cryptocarya miersii (?), both from Chile.—"Bokhara Clover" (Melilotus alba).—Asclepias eriocarpa (twice), from Mendocino County; reported to be poisonous to stock. All of our milkweeds are likely to prove poisonous, and should be looked upon with suspicion.—Casuarina stricta, the "She-oak" of Australia; the wood is very hard and heavy, but beautifully figured, and said to be well adapted for furniture and cabinet work; the specimen was grown in San Diego County.—Inquiry into the uses of Iris ensata pabularia, a forage plant from Siberia.—Stems of Sesbania macrocarpa, "Colorado River Hemp," from Yuma, Arizona. It grows on the bottoms of the Colorado and Gila, near and beyond Yuma; also at The Needles, on both sides of the river; it produces clean stems eight feet high.—Polygonum aviculare, a common weed, said to be made into a tea and drunk for kidney and urinary troubles.—Euonymus japonica, a garden shrub.—Malva parviflora, a common weed.—Malvastrum capense, "Cape Mallow," of South Africa, a garden shrub.—Enterolobium timboiva, Mast., a leguminous tree from Brazil, used in New Granada as a detergent.—Rhamnus californica from San Mateo County, the "Cascara sagrada" of the Spanish-Californians, also known as Coffeeberry; it differs in some points from the northern Cascara sagrada (Rhamnus purshiana), which is sometimes considered only a variety (under the name of Rhamnus californica purshiana), and which now supplies the commercial drug.—For what purpose is Wyethia used in medicine? Wyethia helenioides is "used as a common domestic remedy for coughs and colds by California housewives, and goes under the unmerited name of 'poison-weed.' It has also been adopted among physicians as an officinal drug. The root, which is slightly bitter and aromatic, is made into a tincture and administered for asthma, throat-disorders, and epidemic influenza, with excellent results." (Parsons.) The roots of a plant, which from the description is probably Wyethia mollis, are mashed and used as a poultice for swellings by the Klamath Indians of Oregon, who call it "Stamak." (Coville.)

JULY 1, 1899, TO JUNE 30, 1900.

Adams, Dr. J. Q.; Soldiers' Home, Los Angeles County.—Callistemon rigidus, an ornamental shrub of New South Wales; Pittosporum undulatum, of Australia.

American Beet Sugar Co; Chino, San Bernardino County.—Nitrophila (Nitrophila occidentalis). We have as yet no complete analyses of Nitrophila soil, but this plant appears to indicate strong impregnation with sodium carbonate, the most injurious of the common alkali salts, together with the nitrate, or chile saltpeter.

Bur-clover (Medicago denticulate), Mallow (Malva parviflora), and Goosefoot (Chenopodium murale).

Baird, J. R.; Selma, Fresno County.—Eucalyptus robusta, "Swamp Mahogany Gum." This tree is a profuse bloomer, and is, as suggested, especially valuable for bees, flowering at various times between November and February. The timber is remarkably durable, and is in Australia used for ship-building, wheelwright work, mallets, etc. Eucalyptus robusta is also said to thrive well in low, sour, swampy ground near the seacoast; it was formerly recommended as an avenue and street tree, but is found to be untidy and straggling in its later growth, and somewhat brittle, easily injured by heavy winds. Of the many species of eucalyptus now cultivated in California, the following are considered valuable as bee-trees:

E. buprestium, flowering July–August.
E. calophylla, flowering July–October.
E. corymbosa, flowering August–Dec.
E. diversicolor, flowering November.
E. robusta, flowering November–Feb.
E. polyanthema, flowering January–Feb.
E. leucoxylon, flowering January–April.
E. melliodora, flowering February–April.
E. obliqua, flowering March–May.
E. diversicolor, flowering (again) Mar.–May.
E. longifolia, flowering almost continuously.

Of the above, E. melliodora ("Honey-scented Gum") is particularly rich in nectar, and much sought by bees.

Barnes, Miss Lillian Corbett; Pasadena, Los Angeles County.—Inquiry concerning cultivation of the Litchi nut (Nephelium litchi) of South China and the Philippines.

Berkeley Floral Society; Berkeley, Alameda County.—Red-hot poker plant (Kniphofia aloides), of South Africa.

Berryman, C. W.; Napa Junction, Cal.—Scrophularia californica; asks if it is the Ginseng. Not related to the American Ginseng, Aralia quinquefolia. The only use of the Scrophularia seems to be the production of nectar for bees; it is said to be a good honey plant.

Biggers, Arthur W.; Navarro, Mendocino County.—Soft Chess (Bromus hordeaceus, sometimes called Bromus mollis). The Soft Chess is usually considered a weed, but it is a valuable forage plant, furnishing a great deal of feed, both early and late, for stock on the ranges.

Bishop, Frank D.; Albuquerque, New Mexico.—Trichostema lanceolatum, for name.

California Nursery Co.; Niles, Alameda County.—Specimen of Styrax japonica.

Cantelow, Lorenzo A.; Vacaville, Solano County.—Specimens of a Foxtail Millet (Chætochloa) and an Australian Saltbush. The envelope had been broken in the mail and the specimens were badly mutilated, so that it was impossible to determine them with certainty; but the one appeared to be Chætochloa italica, which is considered as the parent of the common, German, and Golden Wonder Millets of seedsmen. The saltbush is probably Atriplex semibaccata, which is becoming naturalized in places in this State and is a great favorite with chickens. Mr. Cantelow states that his plant has been "greedily devoured by poultry," and that it has a very decumbent habit. Atriplex semibaccata makes large mats sometimes 10 to 12 feet across.

Carter, C. E.; Valleton, Monterey County.—Solanum umbelliferum; asks if it is of any use; he finds it still blossoming with the temperature at 26° Fahr. We do not know of any use to which this plant can be put.

Clark, L. G.; St. Helena, Napa County.—Johnson-grass (Andropogon halepensis).

Cobb, Benjamin; Tracy, San Joaquin County.—Red Brome (Bromus rubens) and Rat-tail Fescue (Festuca myuros).

Conklin Bros.; Newville, Glenn County.—Have had several fine Angora goats poisoned, and send the Toyon (Heteromeles arbutifolia) and a species of moss for determination and report as to whether they are likely to have caused the trouble. Neither of these plants is at all likely to cause poisoning; the berries of the former are eaten by the Indians with great relish and are used by Spanish-Californians to make an agreeable drink. The Californian Buckeye (Æsculus californica) is more likely to be the cause; its seeds are known to be poisonous.

Crikelair, F.; Los Angeles.—Rhus trilobata (?); but material too broken and fragmentary for accurate determination. The plant is called Callala by the Mexicans, and Mr. Crikelair reports that a decoction made by steeping the branch is a good remedy for coughs and lung troubles.

Davis, Mrs. J. C.; Summit, San Bernardino County.—"Squaw Cabbage" (Claytonia perfoliata).

Denicke, E. A.; San Francisco.—Specimen of a plant "growing to some extent upon my tule lands on lower Andrus Island, Sacramento County, and the root of which is said to be poisonous to stock." The specimen sent lacks flowers or fruit, but appears to be a species of Geum, a genus of the family Rosaceæ, which is non-poisonous. It is probable that some other plant is the cause of the trouble, possibly a species of Cicuta, but specimens are needed to determine this point.

Dutard, H.; San Francisco.—Inquiry concerning a grass imported from the steppes of Russia, and said to have considerable merit as a sand-binder; in fact, to be superior to anything else. Mr. Williams, Assistant Agrostologist to the U. S. Department of Agriculture at Washington, D. C., states that this is doubtless the Smooth Brome-grass (Bromus inermis), concerning the value of which the press has been publishing very exaggerated reports. As a matter of fact, he says, the grass does seem to be of considerable value as a sand-binder, under certain conditions, but can hardly be said to be superior to anything else. Bromus inermis was introduced into the United States as a forage plant by the Berkeley Experiment Station about the year 1880, and has been regularly distributed to correspondents for several years.

Lotus glaber and an immature and incomplete specimen of grass.

Edmands, W. O.; Red Hill Ranch, Upper Lake, Lake County.—Seedlings of a native Lupin, probably Lupinus polycarpus, but it is too young for precise determination. We have grown this species for several years and always found it shy of germination and that the yield of green material was too small to make it valuable as a plant for green-manuring.

Emery, Miss E. R.; Los Angeles.—Fungi, for names. Graphiola phœnicis, Mong., on Phœnix; Fusicladium destruens, PK. (?), on Avena; and Erysiphe cichoriacearum, DC. (?), on Nemophila aurita, Lindl. With regard to the Date Palm fungus it is doubtful whether anything can be done to help a plant already affected. Determined by Professor Setchell.

Ferris, John W.; San Francisco.—Seed of a grass, probably Puccinellia maritima. The species of Puccinellia are so closely related that without the whole plant (root, stems, leaves, and unbroken inflorescence) it would be impossible to determine it with certainty. As far as the material goes, it agrees with the description of P. maritima, a species common on the salt marshes around San Francisco Bay, and not likely to have been introduced artificially; it is not a cultivated species. The seed will be sown in the grass garden and named when it flowers.

Fowler, D. T.; Oakland, Alameda County.—Puff-ball (Lycoperdon insculptum, Harkness), from Sierra Valley, Sierra County, altitude about 4,800 feet. Reports that another specimen was seen between Sierra Valley and Truckee. Determined by Professor Setchell.

Artemisia biennis, Willd., from Lockeford, on the Mokelumne, San Joaquin County. A weed introduced during the last few years. The specimen was eight feet high, branched to the base and spreading over an area of about six feet in diameter. This plant is a native of North America, Siberia, and the Himalaya region, but is not indigenous to California. We have specimens collected at West Berkeley, Alameda County, in 1888, and on Andrus Island, in the lower Sacramento River, in 1893. We do not find that hitherto it has proved a troublesome weed anywhere in the United States; this does not imply, however, that in the favored climate of California it may not prove troublesome in the near future; indeed, the robustness of its growth and the enormous quantity of seed produced by each plant indicate that this will probably be the case, unless steps are taken to eradicate it before it gets a firmer hold on the State.

Lupinus affinis (?) and L. pachylobus (?), native Lupins from the east side of the San Joaquin Valley, near Porterville. These are valuable species for green-manuring purposes in the regions where they will grow well; they are annuals, and rot quickly when plowed under; material too young for certain determination.

Euonymus japonicus, an ornamental garden shrub from Japan.

Franceschi, Dr. F.; Santa Barbara.—Acacia penninervis and A. cyclops, Australian species; Acacia subulata; pistillate Ailantus glandulosa from Fillmore, Ventura County.

Gardner, C. H.; Beckwith, Plumas County.—Lupinus minimus and L. rivularis, for information as to value for green-manuring. These two plants are perennials, and their long roots make them unsuitable for plowing-under. We should consider the plants injurious weeds.

Gibbs, R. E.; Berkeley, Alameda County.—Beaufortia decussata and Acacia neriifolia, ornamental garden shrubs, natives of Australia.

Gilbert, T. H.; Berkeley, Alameda County.—"Dyer's Woad" (Isatis tinctoria), from Scott Valley, Siskiyou County, where it has become naturalized in the corner of a grain field. Woad is a European plant, also found in Asia and Japan, formerly in extensive use as a dye, yielding a blue color, but now very little used, on account of the introduction of cheaper dye-stuffs. Of late years Woad has been grown in France as a forage plant for soiling to cows and sheep, for which purpose it is considered superior to Rape, in that it is more hardy, earlier in growth, and that it grows well "on the most arid soils." It is a biennial (flowering and producing seed only the second year).

Guichard, R. A.; Ben Lomond, Santa Cruz County.—Orchard-grass (Dactylis glomerata), Red-top (Agrostis alba), fine specimens of Timothy (Phleum pratense) and Red Clover (Trifolium pratense), grown in the Santa Cruz Mountains at an altitude of 1,200 feet without irrigation or artificial fertilization.

Hall, H. M.; Riverside.—

1196_5. Hordeum murinum, L. (introduced).
1207. Hordeum nodosum, L. (introduced).
1196. Hordeum maritimum gussoneanum, Parl. (introduced).
1349. Stipa parishii, Vasey.
1226, Melica stricta, Boland.
1134_8. Melica imperfecta, Trin.; var. refracta, Thurb.
1111. Melica imperfecta, Trin.
1174. Poa buckleyana, Nash.
1143. Poa fendleriana, Steud. (?)
1130. Poa sp.
1163. Eriocoma membranacea (Pursh), Eat. & Wright.
1172. Poa annua, L. (introduced).
1342. Kœleria cristata (L.), Pers.
1366. Eragrostis major, Host. (introduced).
1115. Festuca myuros, L. (introduced).
1218. Elymus condensatus, Presl.
1210. Bromus maximus gussoni, Parl. (introduced).
1103. Bromus rubens, L. (introduced).
1177. Stipa parishii, Vasey.
1167. Stipa parishii, var., Vasey.
1177. Elymus (Sitanion) sp.
1114. Elymus (Sitanion) sp.
1570. Elymus (Sitanion) sp.
1348. Elymus sp.
1349. Elymus sp.
1365. Bromus willdenowii, Kunth.

1112. Bromus hookerianus minor, Auct.
1269. Poa sp.
1319. Festuca ovina var.
1314. Agrostis exarata, Trin.
1313. Agrostis hyemalis (Walt.), B.S.P.
1328. Alopecurus geniculatus aristulatus, Torr.
1329. Sparganium sp.
1343. Carex sp.
1344. Juncus sp.
1191. Eleocharis sp.
1192. Scirpus sp.

Hannah, R. H.; Ontario, San Bernardino County.—Bromus carinatus, H. & A. "It grows on light, dry soil, and seems to be standing our excessive drought better than anything else. Has it ever been cultivated, and if so what is its value as a meadow grass for hay, or as a pasture grass?" This grass has not been cultivated for agricultural purposes, and we have not yet been able to make analyses, owing to the lack of assistance in our laboratories.

Henry, J. H.; San José, Santa Clara County.—Soft Chess (Bromus hordeaceus, L.), from Templeton, San Luis Obispo County. This grass is now abundant on the stock-ranges of Alameda, Mendocino, and Humboldt counties, and is considered one of the best of forage grasses. It makes an early growth, forming a luxuriant crop of early winter feed. Stock appear not to eat it after it heads out, until the heads are dead-ripe, after which the cattle go over the range again, eating off the heads, which seem to be very fattening. We have not, at present, any analyses of this grass. The principal objection to Soft Chess is that it is an annual, and does not furnish green forage throughout the summer season; some late-growing grass, such as Buffalo-grass, or Blue Grama, is desirable as an addition to the range feed. These two grasses do not, however, make the early start that Soft Chess does, so that if all three species can be had on a range at the same time, one will help to supply the deficiencies of the others. Annual grasses are, however, better adapted to the conditions of the upland ranges of California, than perennial species.

Two grasses from stock range near Templeton, San Luis Obispo County. No. 1, Nit-grass (Gastridium lendigerum), is a late-flowering species, poor in leaf and apparently distasteful to cattle. No. 2, Bronco-grass (Bromus maximus gussoni), is a species of which we have heard diverse reports, but it is usually considered valueless for agricultural purposes. Around Berkeley, stock refuse to eat it, even when young and tender, before "heading out." When ripe the barbed awns or "beards" are reported as being very injurious to stock, working into the eyes and even causing ulcerations of the jaw, much as Foxtail does. Bronco-grass is sometimes mown for hay, when in the milk, before the awns have stiffened, but the hay is said to be inferior in quality. From Santa Barbara County we had reports (evidently exaggerated) as to the value of this grass for forage purposes, but have not been able to confirm them as yet. In the north and in the interior it is considered quite an inferior grass. It is a weedy species and, therefore, spreads rapidly, both because it is distasteful to stock and on account of its profuse seeding and the manner in which the seed is dispersed.

Herrold, W. M.; San José, Santa Clara County.—A native perennial Lupin (Lupinus formosus), a troublesome weed, of no value for green-manuring purposes, on account of the long perennial rootstocks which can not be plowed out and which prevent the plant drying and rotting as it should do in order to produce humus and release the nitrogen.

Hilber, D. D. A.; San Francisco.—Roots of two native drugs from the Shasta region: 1. An Umbellifer, probably a species of Arracacha, indeterminable without more complete specimens of the plant. 2. An Asarum (Wild Ginger), probably A. hartwegi; the latter belongs to the Aristolochiaceæ, a family of which most of the members possess bitter-tonic or stimulant and often aromatic properties, and some of which have long been known for their value in medicine.

Howard, Joseph; Santa Barbara.—Heliotropium curassavicum, from damp land near Lompoc; said to be called "Water weed" or "Devil weed" in Santa Barbara County and considered a troublesome weed; "in cultivation, if pieces are broken off they take root," and it "appears to root very deeply." Asks how it can be killed out and whether a thick crop of Alfalfa would keep it down. It can be eradicated by persistently cultivating with a sharp-tooth cultivator whenever it appears above the ground. As the presence of this plant frequently indicates a superabundance of salts (common salt or alkali salt) in the soil, it is quite possible that Alfalfa would not grow well where the Heliotrope is most troublesome, and in that case the Alfalfa would not have enough vigor to choke out the Heliotrope; if the soil is suited to Alfalfa, however, it is probable that a thick crop of it might kill out the Heliotrope. Under the circumstances, a *cultivated* crop would probably prove more satisfactory, as the Heliotrope would be cut off every time the crop is cultivated.

Inquiry concerning Mesquit-grass. The grass most commonly known as Mesquit, and which is sold under that name by the seedsmen, is Holcus lanatus, otherwise known as Velvet-grass. It is sometimes sown as a forage grass on poor sandy soils, where nothing else seems to do well, but it is one of the poorest of forage plants and not to be recommended where any other kind can be grown. This grass is an annual, but seeds itself very freely, and on this account if it once gets into a district it is apt to become a nuisance in pastures and meadows, occupying ground which can better be sown to more nutritious grasses. Tall Oat-grass (Arrhenatherum elatius, sometimes called Avena elatior) is considered one of the best grasses for poor soils, and makes a more rapid winter growth (if sown in the fall) than almost any other grass we know of. Tall Oat-grass and Orchard-grass, mixed, are being recommended for winter forage.

Irvine, James; San Francisco.—Asks where seed of "Tussock-grass" (Sporobolus airoides) can be gathered, and if it will grow on land subject to submersion from one to six weeks at a time. The Tussock-grass mentioned in the Report on Alkali Soils occurs in great quantity on strongly alkaline soils a mile or two south of Bakersfield, Kern County, and in the Antelope Valley between Rosamond and Lancaster. It is doubtful whether it will withstand submersion for any length of time. The forage grasses best adapted to submersion in California appear to be Bermuda-grass (Cynodon dactylon) and Knot-grass (Paspalum distichum); the former is plentiful in the Sacramento and San Joaquin valleys; the latter is plentiful on the tule lands of W. O. Edmands, Red Hill Ranch, Upper Lake, Lake County. We are not yet in a position to state whether these grasses will tolerate strong alkali salts, but Bermuda-grass often thrives on soils containing quite a noticeable percentage of alkali. Perennial Ray-grass (Lolium perenne) stands submersion fairly well; but it is not an alkali-tolerant plant.

Slough-grass (Beckmannia erucæformis) is said to grow in very strong alkaline soils, and will endure a great deal of standing water, but the seed is not on the market; it has been grown in the Experiment Station grass garden, but the soil appears to be too dry for it to thrive. The plant grows abundantly in the upper part of Honey Lake Valley, Lassen County, and in smaller quantities in swampy places on the road from Bolinas to Olema, Marin County, and near Kenwood, Sonoma County.

Jaffa, Prof. M. E.; Berkeley, Alameda County.—Puccinellia maritima, from salt marsh at San Mateo. Locally called "Biston-grass."

Jobes, J. W.; Escondido, San Diego County.—Inquires about Copernicia cerifera, the Carnauba Palm. It is a native of Brazil, extending into Bolivia and Argentina. This magnificent Fan-Palm has been found hardy as far south as Sydney, New South Wales, by Mr. Charles Moore. It resists drought in a remarkable degree, and thrives on a somewhat saline soil. The stem furnishes starch; the sap yields sugar; the fibers of the leaf-sheets are made into ropes, which resist decay in water; the leaves can be used for mats, hats, baskets, and brooms, and many other articles are prepared from them; the inner part of the leaf-stalks serves as a substitute for cork. This palm, however, is mainly valued for the Carnauba wax, with which the young leaves are coated, and which can be detached by shaking. This is harder than bees' wax and is used in the manufacture of candles. Each tree furnishes about four pounds annually. In 1862 no less than 2,500,000 pounds were imported into Great Britain, realizing about $500,000.

Johnson, W. B.; Merced, Merced County.—Aphyllon californicum, a parasite on the roots of other plants.

Kellner, Capt. Emil; Berkeley, Alameda County.—Hybrid Hippeastrum.

Krauss, F. R.; Berkeley, Alameda County.—Cassia tomentosa of South America, an ornamental garden shrub.

Leeper, J. C ; Bowers, Riverside County.—Mexican Tobacco (Nicotiana glauca); said to be used for perches in chicken-houses in order to keep away lice.

Loughridge, Prof. R. H.; Berkeley, Alameda County.—Polygonum muhlenbergii, a weed in Lake County which has also been troublesome in other parts of the State. As it is found that cattle will eat it to some extent, it is possible that sheep would crop it down closely. Professor Hilgard recommends that this treatment should be supplemented by cutting with the duck-foot cultivator or with the hoe. The main object is to starve out the plant by constantly keeping it from developing leaves, as it will then be unable to "digest" any food. The weed seems to be a native of the State, and not introduced with foreign agricultural seeds.

Lowe, H. N.; Alamitos Nursery, Long Beach, Los Angeles County.—Thirteen specimens of Eucalyptus fruits, of which the material was, in many cases, much too imperfect for accurate determination. E. polyanthema, E. corynocalyx var., E. rostrata, E. paniculata, E. cornuta, E. occidentalis, E. piperita, E. amygdalina var. angustifolia, and E. siderophloia were determined among the rest.

Also asks for list of best species of Eucalyptus for avenue and shade purposes. Of the fifty or more species cultivated in California, E. viminalis, E. ficifolia, E. calophylla, E. capitellata, E. corymbosa, E. polyanthema, E. botryoides, E. rudis, E. cornuta, and E. corynocalyx are considered the best for this purpose; of the remainder, the following are favorite ornamental trees: E. doratoxylon, E. maculata citriodora, E. leucoxylon, E. sideroxylon vars. rosea and pallens, E. lehmannii, E. amygdalina angustifolia, and E. diversicolor.

Lux, Mrs. Nellie D.; Berkeley, Alameda County.—Shoot, without flowers, of a garden plant, probably Anthericum liliago of the family Liliaceæ.

Marsh, R. C.; Oakley, Contra Costa County.—Collinsia bicolor, a common native annual and a favorite garden plant in England, having been introduced from California about 1833. This is a very pretty variety, of which we should like seed for the Botanic Garden.

Meyer, Hy.; San Francisco.—Two plants found blooming in July "in the burning sand of the Mojave Desert." These plants doubtless owe their wonderful vitality, under such adverse conditions, first, to the depth which their long roots penetrate the loose desert sands in search of moisture, and second, to the protection against rapid loss of moisture, which is afforded by the covering on the leaves and young green stems—in the one case of resin, and in the other of wax and fine hairs.

The plants are (1) Eriogonum inflatum, (2) Larrea mexicana. No. 2 is known as the "Creosote-bush," and by the Mexican as the "Gobernadora" or "Hideondo." In many localities, especially in Arizona, the branches of this shrub are thickly encrusted with a certain gummy substance, which careful examination has proved to be almost identical with the East Indian shellac of commerce. This is caused by an insect of the genus Coccus, which stings the young twigs, at the same time laying its eggs in them, causing them to exude the gum. It is said that could this gum be collected in sufficient quantities it would doubtless prove a valuable article of commerce, probably not inferior to the East Indian lac. Dr. E. Palmer writes that it is extensively used by our Indians as a cement by which to fasten their flint arrowheads to the shafts, to mend broken pottery, and to make water-tight their baskets woven of grass and roots. The plant yields a greenish-yellow dye, with which they paint their persons and color their fabrics; but garments so dyed are said always to emit a disagreeable odor on being heated. A lotion made by steeping the branches in water is said to be an excellent remedy for sores, while the leaves dried and reduced to powder are effectively used for the same purpose. Some of our pharmacists say that the plant is a valuable remedy for rheumatism. Miners say that a strong decoction "will clear amalgam." "The dead branches of Larrea remain for many years without decomposing, and, though seldom more than 2 or 3 cm. in diameter, furnished the principal fuel used in the desert by the expedition."—(Coville, Death Valley Exp.) Reported as a wonderful remedy in cases of necrosed and ulcerating bones. Sold at an herb institute on Market Street, San Francisco, near Eighth, as good for syphilis. "No animal in the country will eat it."

Masters, Dr. Maxwell T.; London, England.—Inquires as to whether there are any Cypresses on the Farallone Islands, as Mr. John Ellis, in a letter to Sir Joseph Hooker, dated September 2, 1877, mentions a variety having been collected about seven years ago on the Farallone Islands, about thirty miles from the Golden Gate, in the Pacific Ocean, by a German. "It is a compact upright small tree, silvery in color, and having a nearly round cone, and quite distinct in habit and color from C. manocarpa. The growth is more compact than the latter, and [it is] much slower in growth." There are no trees or shrubs on the Farallones at the present time, nor were there any in 1892; but it may be that one or two existed twenty years earlier, and it would be of interest to learn whether any occurred there at the time of the establishment of the lighthouse.

Maybeck, Mrs.; Berkeley, Alameda County.—Bigonia venusta, of Brazil, an ornamental climbing plant, grown in conservatories in this country.

Milliken, H. F.; Fort Bragg, Mendocino County.—Field Brome (Bromus arvensis), a weed introduced from Europe and considered of little or no value for forage purposes.

Italian Ray-grass (Lolium perenne italicum): This grass is especially recommended for use as an annual hay crop, but is sometimes grown also for two-year lays, or as an admixture with either red or crimson clover. It is considered best adapted to irrigated meadows, and for these it is undoubtedly superior to any other grass. It has also been found serviceable as a pasture-grass for dry hillsides, seeding itself freely.

Barnyard-grass (Panicum crus-galli): This, though an annual, makes a very good forage plant when grown on rich, moist soil. In Mississippi, Professor Phares, as quoted by Vasey, states that it is mown annually, and is said to sometimes furnish four or five tons of hay per acre. It annually re-seeds the ground and requires no cultivation or other care, save protection from stock and the labor of harvesting. In one county in Mississippi hundreds of acres are annually mowed on single farms. Cows and horses are very fond of it, whether green or dry. In South Dakota it is found that *if cut when it first begins to bloom* it yields a very nutritious hay, in large quantities, but it is said not to yield as heavily there as it does in the Southern States. Professor Scribner states that it is very much liked by stock and is a very valuable forage plant for feeding green or for the silo. It is not so well adapted for hay, as it is a coarse, succulent grass, and rather difficult to dry.

O'Bryan, Wm. H.; Altruria, Sonoma County.—A native species of Fescue-grass (probably Festuca californica), but as it is not yet in flower we can not be certain as to its actual identity.

2. The grass certainly produces seed, but we are satisfied it is not one of the few species sold by seedsmen.

3. The best way to propagate it will be to collect all the seed one can find, when it is ripe (probably in July or August), and at once sow it on soil which has been plowed or spaded, and to keep it fenced off from

stock and chickens for one year, in order that the plants may become thoroughly established. After that it may be grazed systematically and will not need re-sowing, as it is a perennial; but if it is desired to have it increase still more, stock should be kept off it from about June until it has flowered and scattered its seed again.

4. Until we can see the grass in flower we can not speak with certainty of its forage value, but as the foliage is somewhat coarse we have doubts as to its being of as much value as Italian Ray-grass (Lolium perenne italicum) for places in which the latter would thrive; it is possible that it may prove better adapted to the soil and climatic conditions of that particular locality than the Ray-grass, and thus offset certain disadvantages.

Osborne, J. S.; Healdsburg, Sonoma County.—Liriodendron tulipifera, the Tulip-tree of the Eastern States.

Osterhout, W. J. V.; Berkeley, Alameda County.—Iris sambucina, L.

Paige, Cutler; San Francisco.—Yerba Santa (Eriodictyon californicum) and Mountain Lilac (Ceanothus foliosus). The former is considered valuable as a tonic, and is used in domestic practice in cases of cold and asthmatic troubles.

Patchell, R. K.; South San Francisco, San Mateo County.—Lupinus affinis, the "Succulent Lupin."

Pease, C. J.; Olema, Marin County.—Poison Hemlock (Conium maculatum) and Fennel (Fœniculum vulgare). Conium is the true "Poison Hemlock," the classical plant famous as having been used by the Greeks to poison Socrates and other State prisoners. The whole plant from root to seed is poisonous; the seeds and leaves (especially in flowering time) are especially poisonous; the root is said to be nearly harmless in March, April, and May, but is dangerous afterward, especially during the first year of its growth. Mr. V. K. Chesnut, of the U. S. Department of Agriculture, reports that recent cases of poisoning have arisen from accidentally eating the seed for that of anise, the leaves for parsley, or the roots for parsnips; also from blowing whistles made from the hollow stems. He adds that many domestic animals have been killed by eating the plant, the prominent symptoms described for cows being loss of appetite, salivation, bloating, much bodily pain, loss of muscular power, and rapid feeble pulse.

The yellow-flowered plant, Fennel (Fœniculum vulgare), belongs to the same family (Umbellifereæ). The leaves and fruits are used as condiments, and the bleached leaf-stalks are known as Carosella-salad. It is said to serve as sheep-fodder, withstanding the worst of droughts.

Pillsbury, A. J.; Tulare.—Mallows (Malva parviflora). "Cows eat it some when it is green, but it comes when there is plenty of other stuff that they like better. After it has died down and bleached all summer, the cattle will eat every bit of it about a barnyard, and they are particularly fond of the seeds. It may be valuable to cut and stack in times of abundance, to be fed in season of scarcity."

Ramsand, J. C.; Florence, Los Angeles County.—One of the Pigeon-grasses, either Chætochloa viridis or C. caudata; better material needed. Asks whether it is detrimental to the county, and if not whether it is a good forage grass. C. caudata is considered a troublesome weed in the

East, and as being of no value for forage purposes; its extirpation by cultivation throughout the season, with hoe and crops, is recommended. Nevertheless C. caudata, a native of Arizona, New Mexico, and Texas, is said by some writers to be a good forage grass.

Rennie, James; Natoma, Sacramento County.—Three native Clovers: (*a*) Trifolium furcatum, (*b*) Trifolium gracilentum, (*c*) Trifolium tridentatum. All these are valuable forage plants, especially T. furcatum.

Rimpan, Frank T.; Los Angeles.—Silk-cotton from Mexico; states that the natives have succeeded in making very handsome blankets from the fiber, and that it is also said to be used among them to make a kind of explosive that is more powerful than our gun-cotton. As far as we can determine without flowers or leaves, the fiber is that of the Kapok-tree (Eriodendron anfractuosum). This tree is known in Mexico and Central America as the Ceiba or Pochote. In Java it goes under the name of Kapok floss tree, and in Yucatan that of Pemm. The Kapok produces the most valuable of all the silk-cottons from a commercial standpoint. In Europe it is used extensively for upholstery, the staple being too short and too little twisted to be spun. But these very qualities are especially valuable to the upholsterer for stuffing cushions, mattresses, etc.; its elasticity and harshness prevent its becoming *matted*, as is the case with some other fibers. The European trade in Kapok is almost entirely with Java; the tropical-American peoples do not appear to export it to any extent, though they use it for many domestic purposes, such as candle-wicks. Since the Chicago Exposition, Kapok has come into commercial use in this country, as an upholstery fiber. The Kapok is a tropical tree, but we find it thrives very well in our "Temperate House," which is artificially heated only during the cold winter nights, and which has a moist atmosphere from frequent spraying.

Robinson, T. H.; Lancaster, Los Angeles County.—Panicum crus-galli var.; a variety of the Barnyard-grass, of which the Mojave Indians used to collect the grain, grind it into flour and cook it for food. It is considered useful for stock-feeding, either green or for the silo, and is said to be much liked by cattle. It is not well adapted for hay, as it is a coarse, succulent grass, and rather difficult to dry, though in the vicinity of Lancaster this last feature would scarcely be noticeable. Mr. Robinson states that the grass came up plentifully with this year's sowing of alfalfa.

Rueff & Herman; Bonnie Doon, Santa Cruz County.—Lupinus nanus, a native Lupin (annual) suitable for green-manuring.

Russ, William; Ferndale, Humboldt County.—"Prickly Comfrey" (Symphytum peregrinum). The plant is growing in a field near the house and is spreading rapidly; it proves hard to kill out. Prickly Comfrey is a native of the Caucasus, where it is used as a forage plant, being eaten with avidity by domestic animals, in spite of the roughness of its leaves. It is a deep-rooting perennial plant, producing a great abundance of foliage, in good soils which keep their humidity all the year; on shallow and dry soils it is said that only a mediocre crop, or almost none at all, is produced. As it is a watery plant, it should be grown along with plants which contain more nutriment in less volume. At Berkeley it grows readily from seed and produces a heavy crop of leaves without irrigation, on deep alluvial bottom soils. It has not been tried on our hill lands. Smith states that if properly cultivated it will yield forty to fifty tons of green stuff to the acre, and that it is rich in gum, mucilage, and sugar. It grows easily from seed or tops, and a few plants should be tried in the Bear River country, near Cape Mendocino. Its deep-rooting habit and the production of so much green feed at the driest season of the year, are strong points in its favor, for regions where alfalfa can not be grown.

Scott, Frances; Shasta, Shasta County.—Leaf of the Garden Geranium (Pelargonium hortorum); a branch producing pure white leaves grows from the junction of two decayed stocks; both the stalk and all the leaves put forth are pure white; asks whether removed and planted as an independent plant it would continue to be white. This is a case of blanching or etiolation, as botanists call it, and it is caused by the absence of chlorophyll, probably due to some pathologic condition of the plant. It would be of interest to try to propagate this etiolated stem as a cutting, in order to determine whether the whiteness will continue. We are not aware that this experiment has ever been tried upon such an eminently suitable subject as the Geranium, which grows so readily from cuttings. An instance is on record of the restoration of the green color to an etiolated plant by the injection of tincture of iron. This would be an interesting and simple experiment to try, if one wished to find out more about a subject of which a very little is at present known.

Sessions, Miss Kate; San Diego.—Melaleuca leucadendron, the green-flowered Australian variety of the East Indian Cajeput-tree, and might well be distinguished by a horticultural name such as chlorantha or australiensis.

Shelly, Harold H.; Cupertino, Santa Clara County.—A Peziza or cup-fungus, very similar to one which grows in Europe on horse-dung.

Shinn, Charles H.; Niles, Alameda County.—Acacia longifolia sophoræ and Leptospermum lævigatum, Australian sand-binding shrubs cultivated in Golden Gate Park.

Smalley, Robert; Blocksburg, Humboldt County.—Cultivated leguminous plant, of which the specimen is too incomplete for determination.

Smith, F. Warren; Pinole, Contra Costa County.—Inquiry as to the most suitable varieties of Bamboo for that vicinity; where are they cultivated and where can roots be obtained? Very few of the best varieties of bamboo have as yet been tested as to hardiness around San Francisco Bay; probably many more, especially of the Chinese and Japanese varieties, could be successfully cultivated, but at present the demand for novelties in this direction does not seem to warrant nurserymen in introducing expensive varieties. The following hardy species are on sale by nurserymen; the nomenclature is in great confusion and can not be relied upon:

Arundinaria falcata, of the Himalayas; a very ornamental and graceful species, quite hardy at Berkeley; stems slender, 6 to 10 or even 20 feet high; leaves 3 to 6 inches long.

Arundinaria simoni, a handsome, tall, hardy species, growing as much as 10 feet in a single season; leaves average about 10 inches long by ¾ inch wide; stems 3 inches in circumference on old plants.

Arundinaria japonica, the Metake Bamboo, a dwarfer species (7 to 11 feet high), with stems ½ to 2 inches in circumference, slightly arched; leaves 8 to 12 inches long, 1½ to 2 inches broad.

Another species, not yet identified by us, is sold as Bambusa viridis stricta; it is said to be a vigorous-growing, hardy, Japanese species, with long green leaves marked with bands of yellowish or deep green.

These Bamboos can be obtained from several nurserymen in the State.

In addition to these species, the following hardy varieties are offered in southern California:

Arundinaria fortunei; Japan; dwarf, spreading; leaves beautifully variegated, the white predominating.

Arundinaria hindsii; China and Japan; 15 feet high; branchlets upright; leaves narrow, grasslike. Quite peculiar in habit and aspect.

Arundinaria macrosperma; southern Atlantic States (forming the so-called "Canebrakes"); 18 feet high; foliage very ornamental.

Bambusa castillonis; China and Japan; stems 20 feet high, 1 to 2 inches in diameter, bright golden yellow, striped with green; leaves striped pale yellow.

Bambusa erecta; Japan; 10 to 15 feet high; branchlets and leaves upright.

Bambusa quadrangularis; Japan; dwarf; stems quadrangular; curious and interesting.

Bambusa tessellata; China; dwarf; stems thin; leaves very large, tessellated with yellowish variegation.

Phyllostachys aurea; North China; stems golden yellow; 12 feet high.

Phyllostachys bambusoides; Japan; 12 feet high; stems thin, but very strong; formerly used for arrows.

Phyllostachys mitis; North China; stems 60 feet high, 2 inches in diameter.

Phyllostachys nigra; North China; stems 15 feet high; jet black when mature; variety punctata has the stems spotted with yellow.

Phyllostachys viridi-glaucescens; North China; considered by Dr. Franceschi the best of the hardy species; stems deep green, turning to yellow; 40 feet high, about 1 inch in diameter; spreads rapidly.

Propagation of all Bamboos is effected by careful division of the roots just at the time new growth commences, and it is often considered advisable to start the new plants so obtained in pots, as they are otherwise rather slow of growth at first. Large clumps may be moved very successfully and without any setback, if taken up at the time of new growth and well watered after planting, in order to settle the soil around the roots. Irrigation during the summer, especially during the first year or two after planting, will help materially to produce the most ornamental, large, and healthy specimens. Bamboos love rich, deep, alluvial soils, but can be readily grown elsewhere.

Smith, Jere; Hawkins Bar, Cal.—Bronco-grass (Bromus maximus gussoni), a native of South Europe and becoming a troublesome weed in California. The awns or beards are said to be injurious to the mouths, eyes, and ears of animals, though we do not know of any cases of injury actually traceable to this cause. The grass is said to be of but little agricultural value, as stock appear to dislike it at all stages of its growth. It has been found that by cutting when in the same stage that barley is cut for hay, that is, when the heads are green and soft, it makes hay of fair quality. If it has not spread too far, it would be advisable to eradicate this grass from the ranch. As the plant is an annual of shallow-rooting habit, it can be readily destroyed by cutting or pulling before the heads have matured.

Snow, Frank; Berkeley, Alameda County.—Atriplex canescens (?), a native Saltbush, from Butte County. Fruit is needed in order to determine the species with certainty, as there is at least one other species with leaves resembling this one. Atriplex canescens is common east of the Sierra Nevada, in Nevada, Arizona, and New Mexico, and is said to be the principal forage plant over a wide range of territory in those States; the leaves and small twigs are eaten by cattle, which grow fat on them, but they are said to give a bad taste to the milk.

Australian Saltbush (Atriplex semibaccata).

Spring Valley Water Co.; San Francisco.—Wild Lettuce (Lactuca scariola), from Pleasanton, where it covers almost fifty acres of ground, and is considered a weed. The best method of eradication is hoeing; mowing down just before flowering might prove successful, but it is possible that secondary shoots would be thrown up from the base of the stem, needing a second mowing. It is becoming a bad weed and rapidly spreading in the State.

Squires, H. W.; Berkeley, Alameda County.—Atriplex canescens, from the Panamint Mountains, Inyo County, Cal. Its presence is considered an invariable sign of the occurrence of water within twenty feet of the surface; it grows on the lower slopes of the dry hillsides, especially along the gullies.

Stivers, H. F.; Rosewood, Tehama County.—Trifolium watsonii, a native Clover, little known as yet, and apparently quite rare.

Stockton, Dr. T. C.; San Diego.—Weeds growing on alkali soil sent for analysis: (1) Samphire (Salicornia): a plant indicative of a very high percentage of alkali salts; (2) Salicornia and Cressa cretica truxillensis; (3) Salicornia and Mesembryanthemum (probably M. crystallinum). The presence of any one of these plants is usually indicative of a large percentage of alkali salts.

Suhren, George H.; Collinsville, Solano County.—Xylothermia montana, a very ornamental shrub of the Leguminosæ (Pea and Bean) family, native of the Coast Range Mountains and forming a part of the "chaparral"; the blossoms are large and showy, and the spiny nature of the bush would render it useful as a hedge shrub.

Swingle, W. T.; U. S. Department of Agriculture, Washington, D. C.—Twenty-three specimens of Eucalyptus for names.

Taylor, M.; San Francisco.—(1) "Buttercup" (Ranunculus californicus), said to make cows' udders sore. The juice of the Ranunculi is acrid and somewhat poisonous, often causing blisters on sensitive skins.

(2) "Yarrow" (Achillea millefolium); sometimes used in small quantities as an admixture with pasture-grass seed, on account of its drought-resistant qualities, early growth, and the fact that stock keep it closely cropped. It is a native of both Europe and California.

(3) Baccharis consanguinea.

Trumbull & Beebe; San Francisco.—Seed of Rescue-grass (Bromus willdenowii, frequently called B. unioloides).

Twitchin, Geo.; Byron Hot Springs, Contra Costa County.—(1) Mexican Tobacco (Nicotiana glauca), naturalized from Mexico; (2) Orthocarpus purpurascens, a native annual.

Voght, Dr.; Palmdale, Los Angeles County.—Thirteen specimens of plants from the Antelope Valley: No. 64, Nicotiana glauca (Mexican Tobacco); No. 1, Tetradymia spinosa; No. 14, Erigeron canadensis (introduced weed); No. 51, Monolopia major; No. 2, Capnorchis chrysantha; No. 54, Grayia spinosa; No. 71, Heterotheca grandiflora; No. 72, Diplacus longiflorus; No. 18, Datisca glomerata; No. 11, Salazaria mexicana; No. 33, Eurotia lanata; No. 23, Adenostona fasciculatum; No. 15, Eriogonum inflatum.

Warner, D. A.; San Francisco.—Prunus Lauro-cerasus, the Cherry-laurel, native of Persia and adjacent countries. From the leaves is distilled the medicinal laurel-water; they contain hydrocyanic acid, and are used by amateur entomologists in the preparation of killing-bottles, while an infusion is said to be effective in destroying all kinds of insect parasites on garden plants, and is further recommended for admixture with whitening in buildings, to kill flies. In domestic cookery the leaves are occasionally used to give flavor to blancmanges, but care has to be used, as they produce a deadly poison if allowed to remain too long in the liquid.

Waugh, H. C.; Talmage, Mendocino County.—Soft-leaved Vanilla-grass (Savastana macrophylla); good for sachets and to place among household linen. It is not on record that stock will eat it; probably it has too strong an odor and too bitter a taste. It is a common grass throughout the redwood region.

Weringer, Joseph; Bakersfield, Kern County.—Trichostema lanceolatum, "Turpentine weed." We do not know of any reputed medicinal value for this plant, nor of any other use to which it can be put. [Subsequently reported as useful in cases of stomach and bowel trouble.]

West, B. W.; Garden Grove, Orange County.—Inquiry as to the best varieties of roses for yielding essential oil of roses. Some eight varieties are said to be used for this purpose, as follows: Rosa rugosa var. flore-pleno, R. alba var. (R. gallica crossed with R. canina ?), and R. sempervirens are the least used; Rosa moschata (the Musk rose) is said to be used especially in the preparation of rose powder; Rosa gallica, L. (the French or Dutch rose) and R. centifolia are both used extensively, especially in the preparation of rosewater. The most important species are the Rosa gallica var. provincialis and R. damascena (the Damask rose); the former is the variety especially esteemed in southern Europe, and the latter in Bulgaria, while in India (around Lucknow) the latter is used in preference to other species.

Whyborn, Mrs. H. K.; Pasco, Franklin County, Washington.—Inquiry concerning the probable value of Spartina glabra for retaining the crumbling banks of the Columbia River. Referred it to Professor Scribner, who has had field agents in that region this summer.

Wightman, Temple; Skyland, Santa Clara County.—Inquiry concerning the honey-yielding sagebrushes. The White Sage (Salvia californica) is restricted to southern California and does not appear to have been found wild north of the Tehachapi. The Black Sage (Salvia mellifera) also grows in southern California, but extends northward to Sonoma County.

Wilkinson, J. A.; Live Oak, Sutter County.—St. Barnaby's Thistle (Centaurea solstitialis); inquires whether it is the Russian Thistle. A very different plant from the Russian Thistle. When cut green it is said to make good hay, which is eaten by stock in preference to wheat-hay in spite of the "prickers" with which it is well armed. It is a troublesome weed when growing with such crops as alfalfa. The only really successful method of eradication known to us is hoeing when the plants are young, or cultivation of the ground with hoed crops.

Winchell, L. A.; Tollhouse, Fresno County.—Rhamnus californica, the Cascara sagrada of the Spanish-Californians; it differs from Rhamnus purshiana of the north. Though the latter plant is said to be the plant from which the Cascara sagrada of commerce is now almost exclusively obtained, Rhamnus californica was the species used by the Spanish-Californians. Its bark is now the subject of an investigation by the Pan-American Congress on our native medicinal flora. Mr. Winchell reports that the plant grew at about 4,200 feet altitude.

Woodworth, Prof. C. W.; Berkeley, Alameda County.—Three hosts of scale-insects: Acacia mollissima, A. longifolia sophoræ, and Anagallis arvensis.

Wyndham, Mrs. Hugh; Redding, Shasta County.—Gilia dichotoma, one of our common spring annuals.

Zumbro, E. A.; Riverside.—Poison Darnel (Lolium temulentum); is it the "Tares" of the Bible?—It is considered by some authors as the Tares of the Scripture parable.

Miscellaneous Plants Sent In.—Tagaste (Cytisus proliferus), a forage and bee shrub of the Canary Islands, of which seed was once distributed by this Station.—Australian Pea-vine (Dolichos lignosus), an ornamental climber.—Corn Spurrey (Spergula arvensis), an annual weed naturalized from Europe.—Gopher plant (Euphorbia lathyris).—Antholyza æthiopica immarginata, an ornamental herbaceous plant from South Africa.

JULY 1, 1900, TO JUNE 30, 1901.

Abraham, C. C.; Western Nurseries, San Francisco.—Erica ventricosa grandiflora, Hort.

Adams, Dr. J. Q.; Soldiers' Home, Los Angeles County.—The Caracol or Caracalla Bean (Phaseolus caracalla, Linn.), which grows wild in nearly all tropical countries. It grows freely in sheltered places as far north as Berkeley, and is propagated either by seed, or by cuttings started in sand under glass. This plant is sometimes known as the Climbing Snail-flower.

Three ornamental garden trees: Grevillea robusta of Queensland and New South Wales, family Proteaceæ; Casuarina glauca, Australia; Leucadendron argenteum, Silver-tree of South Africa.

Ames, Mrs. Mary E. Pulsifer; San José, Santa Clara County.—Cestrum elegans, of Mexico, and Coronilla emerus, the Yellow Scorpion-Senna, of southern Europe, two ornamental shrubs.

Senecio grandifolius, native of Mexico, a half hardy shrub, useful for massing or isolating on the lawn as a foliage plant.

Atkinson, D. G.; Hopland, Mendocino County.—Bromus lævipes, a native perennial grass related to Rescue-grass. Mr. Atkinson reports that it has "recently appeared here. It seems a very tenacious perennial and grows anywhere; does fine in brush on any poor land." This grass has no common name, as far as we are aware; it is a perennial and is a native of California, Oregon, and Washington. The forage value is at present unknown and seed is not on the market; it can only be obtained by collecting from the wild plant.

Bates, W. A.; Dinuba, Tulare County.—Three species of Acacia: the Black Acacia (A. melanoxylon), Green Wattle (A. mollissima), and a species needing better material for determination. Also asks which species can be recommended for rapidity of growth, spread of branches, and shade and windbreak purposes. We consider Acacia mollissima most suitable; we have had specimens which grew over thirty feet high in three years.

Bayha, John P.; Clair, Orange County.—Fog-weed (Atriplex expansa), a native annual saltbush of alkali soils. Mr. Bayha reports that it makes good hay if cut in May and treated like wheat or barley hay, that horses, calves, and milch cows seem to prefer it to grass, and that the latter do not lose milk when fed on it.

Bean, George E.; Bieber, Lassen County.—Seed sold him by a local seed firm for and under the name of Bromus inermis, "Australian-raised." The "Australian-raised" seed is that of Rescue-grass (Bromus willdenowii, sometimes called B. unioloides), a good forage plant, but one which should not have been sold as Hungarian Brome-grass. Mr. Bean reports having been greatly pleased with Hungarian Brome-grass raised from Dakota-grown seed.

Blake, F. A.; Rayneta, Riverside County.—Orchard-grass (Dactylis glomerata): "Grows well on very wet heavy soil, makes good pasture, and gives one crop of fair quality hay. It will stand any amount of water, growing on ground too swampy to drive over."

Kellogg's Spear-grass (Poa kelloggii), a rare native grass, seldom collected, and of unknown forage value.

Bodwell, C. A. Jr.; Lakeville, Sonoma County.—Four Eucalypti. No. 1 appears to be Eucalyptus longifolia, the "Woolly Butt," but we can not be absolutely sure without well-developed buds with the calyptra attached. E. longifolia is a valuable bee-tree, as it flowers almost continually.

No. 2 is E. tereticornis, the "Flooded Gum." It is said to thrive even on undrained ground, and in Australia the timber is used by wheelwrights.

No. 3 is E. goniocalyx, the "Bastard Box-tree." In Australia this tree is sometimes found at an elevation of 4,000 feet; the timber is said to be especially esteemed for wheelwright's work. It is also used for house-building, fence-rails, etc., and makes excellent fuel.

No. 4 appears to be E. paniculata, the "Red Ironbark"; but in this case, also, mature buds are needed, with the calyptra still attached, in order to be absolutely sure of the specific name.

Bosworth, G. E.; Blocksburg, Humboldt County.—French Lentils (Lens esculenta). The dried seeds of the French Lentil are a favorite human food, being used chiefly for soups and stews. Lentils are said to be the most nutritious of all vegetables, as they contain about 23 per cent of casein, 35 per cent of starch, and only 14 per cent of water. The foliage and stems make good forage, the plant being especially valuable for cultivation on light, sandy soils and at high elevations. The variety called the Winter Lentil, which is usually sown in September or October, is said to be more prolific than the Summer Lentil; the latter is usually sown in March or April. The Winter Lentil is also valuable as a green-manure plant.

Braunton, E.; Los Angeles.—Information about Acacia aulacocarpa. This tree is known as the "Hickory Wattle," and is indigenous to central and northern Queensland; it will probably, therefore, be somewhat sensitive to frost. It yields a hard, heavy, tough, dark-red wood, useful for cabinet-work; the bark is said to be used to some extent for tanning.

Hall's Totara (Podocarpus hallii), of New Zealand. The timber is said to be "of a dull red color, close in the grain, and of fine texture. It is excellent for marine piles, as it resists the attacks of the teredo for a considerable period, although not absolutely proof against that destructive mollusk. It is largely employed for buildings of a superior class, and is extensively used for bridges, wharves, etc." The two trees are doubtless of the same species; the broad-leaved being perhaps the younger.

Leaf of Cassia lævigata.

Brown, D. J.; Last Camp, Napa County.—Seeds of the Large White Lupin (Lupinus albus), received from Portugal, where the plants are used for green-manure; the seed is said to be "sown broadcast in the fall, the plants making a strong growth by spring, when it is turned under." We have been distributing seed of this plant for green-manure purposes, during the last two seasons.

Brown, David R.; Corona, Riverside County.—Sends plants for identification and information as to poisonous qualities: No. 1, Astragalus crotalariæ; No. 2, Astragalus sp. (too immature for definite determination). We are interested in hearing that the above-named plant is among the "loco-weeds," as it does not appear to have been previously reported as injurious to stock. The subject of loco-poisoning has recently been investigated by the U. S. Department of Agriculture, Washington, D. C., and the following notes are from a lengthy publication of the Department dealing with the general subject of plants poisonous to stock:

Loco-poisoning usually affects particularly the brain and eyes of animals. It has been found that the eating of loco-weeds by stock is an acquired habit which spreads rapidly among other animals when once started; the habit seems to be acquired by imitation. The loco disease may assume either an active or a chronic form; in the active form the animal lives but a few days, while in the chronic form it may live for two or more years and manifest the same symptoms in a milder degree. Locoed horses may be used to best advantage (if not badly diseased) as draft animals, but they must be maintained in good condition and prevented from eating loco-weeds. Locoed horses may work or travel in a perfectly normal manner for days at a time; they frequently, however, run away or are attacked with fits without any apparent external cause. Although an apparent recovery may be brought about in locoed sheep and horses, such animals when allowed to run upon a range again, almost invariably return to their old habit of eating loco-weeds. Animals which have once been locoed are, therefore, not to be considered suitable for stocking the range, for the reason that the majority of them will become locoed again, and for the additional reason that other animals will learn the habit and the loco disease will thus spread among the stock. In the case of horses which have been kept away from the weed for a considerable length of time, the value of the animal is a very uncertain quantity. Such horses may return to the habit of eating loco-weeds at the first opportunity, and even if prevented for a time they may develop vicious habits. A small percentage only of locoed horses apparently make a complete recovery and develop into valuable and reliable animals.

Byxbee, Miss E.; Fruitvale, Alameda County.—Lavatera olbia, a south-European shrub, cultivated in gardens, but inferior to our native L. assurgentiflora as a horticultural plant.

Campbell, Robert; Foster, San Diego County.—Many-flowered Millet-grass (Oryzopsis miliacea): This grass was sent out by this Station several years ago under the name of Milium multiflorum; it is a native of the Mediterranean region of South Europe, and was received by us from New Zealand, where it has been found valuable in dry situations; an account of it is found in the Report of this Station for the years 1895–97, p. 271.

Chandler, H. P.; Berkeley, Alameda County.—Acacia mollissima, the Green Wattle of Australia.

Coburn, C. E.; Penryn, Placer County.—California Lotus or Dakota Vetch (Lotus americanus): This plant belongs to the family Leguminosæ (Pea and Clover family), and is a good nitrogen-gatherer, but its season of growth and flowering is too late to make it available for California orchards, as it will withdraw too much moisture from the soil. Wherever it makes a heavy early growth it would be good for plowing-under. It is a serviceable forage plant for arid regions.

Cosner, Robert; Colusa, Colusa County.—California Lotus or Dakota Vetch (Lotus americanus) and Sida hederacea, two grain-field weeds, for names and method of extermination. Sida hederacea is a perennial and can only be exterminated by persistently cutting the stems below the surface of the ground as fast as they appear. Lotus americanus is an annual of some value as a forage plant. Being an annual it can readily be exterminated by cutting off at the surface before the seeds have had time to mature and scatter.

Cowan, T. W.; Pacific Grove, Monterey County.—Albizzia lophantha of southwest Australia.

Crawford, C. H.; Petaluma, Sonoma County.—Crab-grass (Panicum sanguinale), for name and information as to forage value. Mr. Crawford says that his "horse and cow are both very fond of it." Professor Scribner, of the U. S. Department of Agriculture, Washington, D. C., reports as follows upon this grass: "A well-known annual, common in nearly all parts of the United States, growing in cultivated fields, and about dwellings. It is a weed in gardens and among hoed crops. In grain-fields after harvest, it frequently springs up in such quantity, particularly in the Southern States, as to yield one or even two good cuttings of hay. This spontaneous growth affords excellent pasturage, as well as hay of first quality if properly cured. The stems are much branched, and in good soil attain a length of three to four feet. This grass contains little fiber, and dries quickly when cut, but if after cutting it is wet by rains or heavy dews its value for hay is almost wholly destroyed. In Bohemia, Crab-grass is cultivated upon sandy soils and the grain is used for food in the form of mush or porridge."

Crikelair, Frank; Los Angeles.—Rhus trilobata: Mr. Crikelair states that it is good for coughs and asthma. The family to which this plant belongs (Anacardiaceæ) is characterized by a peculiar acridity. The plant is known as "Callalla"; the foliage is ground up to a powder for use in cases of asthma; it is taken in the form of a hot tea morning and night.

Denninger, G.; San José, Santa Clara County.—Matilija Poppy (Romneya coulteri): The name Matilija comes from the Matilija Cañon, Ventura County, where the plant is abundant. See Mrs. Parson's account of it in "Wild Flowers of California."

Doyle, John T.; Menlo Park, San Mateo County.—"Hoary Cress" (Lepidium draba, L.): A native of Europe and Asia, adventive in the United States, but only sparingly met with and never before (as far as we can find) recorded as a troublesome weed. It has been found at Astoria, N. Y.; on ballast at the Atlantic seaports; in Colorado; and in California at Berkeley and in the Napa Valley. Mr. Doyle reports that it is a pernicious perennial weed, rooting very deeply, and very hard to eradicate. The only method we can suggest, that is likely to be beneficial, is to persistently keep the foliage from appearing above the surface.

Eaton, Thomas E. N.; Redlands, Riverside County.—Salvia columbariæ, an ornamental native annual.

Edmands, W. O.; Red Hill Ranch, Upper Lake, Lake County.—Hairy Vetch (Vicia villosa): States that it is promising as a green-manure crop, having this year made a four-foot growth in time to be plowed-under before the last spring rains; also, that as hay it is readily eaten by cows. The seed was sown in January on red-hill land on which Kafir Corn had been grown. Hairy Vetch is being highly recommended both as a green-manure and as a forage crop.

Fleming, A. C.; Lincoln, Placer County.—Johnson-grass (Andropogon halepensis), a forage grass which is said to be but little affected by drought, and the hay, "if cut just as the grass is coming into bloom," is much liked by all kinds of stock. Two or three cuttings may be made during a season. Hogs are very fond of the thick, fleshy rootstock. Johnson-grass is a terrible weed in agricultural land or orchards, and unless a man intends to give up the whole of his land to it permanently, it should never be planted and every means should be taken to eradicate it if found there.

Fowler, D. T.; Oakland, Alameda County.—Prairie Triple-awn (Aristida oligantha, Michx.), an annual grass of Texas and the Middle States. In the Eastern and Middle States, according to Scribner, the species of Aristida are deemed of little or no value, but in the Southwest, where any mouthful of fodder of any sort has value, they are not wholly worthless. This grass appeared in Tehama County, in the lava-bed region on the east side of the Sacramento River, about the year 1888; in 1894 it was growing over a large area of the county, having extended south, on both sides of the river, some twenty miles. According to Dr. J. S. Cameron, of Red Bluff, it is green during June, July, and August, never appearing until the summer begins, and is an excellent food for stock of all kinds, hogs doing exceptionally well on it.

Weeds from Fernley, Nevada County.—Hypericum sp., a weed in grain-fields and on roadsides, seeding after the grain is cut and spreading rapidly; in the East, Hypericum perforatum "is too well known as a pernicious weed, hard to extirpate."—Lamb's Tongue (Plantago lanceolata, L.), choking out alfalfa, "as it comes up more quickly than alfalfa after cutting."—Crab-grass (Panicum sanguinale), spreading rapidly; an annual weed, perhaps not dangerous and of some value for hay. The best method of treatment would be to cut the alfalfa early, before the Crab-grass has had time to seed, and put the mixture into the silo; the two would make an admirable ration as silage.

Fowler, Carroll; Berkeley, Alameda County.—Atriplex confertifolia and Atriplex polycarpa (?), from Lone Pine, Inyo County. The roots of these plants were attacked by scale insects.

Frei, Mr.; Berkeley, Alameda County.—Xerophyllum tenax, from near Calistoga, Napa County. This plant is not uncommon northward from Marin to Humboldt County, on dry ridges; the leaves are highly tenacious and are used by the Hupa Indians for basket-weaving.

Gardiner, P. H.; Isleton, Sacramento County.—Bull-thistle (Cirsium lanceolatum), for name and method of eradication. A native of Europe, and naturalized within recent years in the San Francisco Bay region, the lower San Joaquin Valley, etc. It is an annual or biennial weed and can be eradicated by persistent hoeing; occasional mowing before the plants flower is also recommended, but in any case the point to be borne in mind is to prevent the seeding of the plants.

George, Dr. W. S.; Antioch, Contra Costa County.—Asclepias californica, Greene: "A weed brought to me by a farmer who says it is killing a great number of cattle, horses, and sheep." This species was first observed by Professor Brewer, who collected it May 20, 1862, on a "hill north of coal mine, Mount Diablo." Several species of Asclepias are considered poisonous to stock, and this is not likely to be an exception.

Gilbert, Mrs. T. H.; Berkeley, Alameda County.—Muehlenbeckia complexa of New Zealand, an ornamental climber.

Goddard, P. E.; Hupa Valley, Humboldt County.—Plants used by Indians: Quercus garryana; Iris macrosiphon; Wyethia angustifolia; Asclepias speciosa; Nicotiana bigelovii (from Ukiah); N. attenuata.

Goff, T. J.; Hooker, Tehama County.—Johnson-grass (Andropogon sorghum halepensis).

Goodman, Mrs. M. A.; Outing, Riverside County.—Yellow Pentstemon (Pentstemon antirrhinoides, Benth.). Mrs. Goldman reports that it is "a fine honey-plant."

Hache, L.; Oxnard, Ventura County.—Sour Clover (Trifolium furcatum, Lindl.); asks where seed can be procured. Mr. Hache found it growing on very strong alkali, and believes it will be valuable as a green-manure plant for such situations. Sour Clover is not uncommon in low saline or alkaline fields in the Coast Range valleys as well as in the Sacramento and San Joaquin valleys. It is considered a good forage plant, stock eating it readily; but as with other plants, cattle bloat easily if fed with too much of it at one time. We have long known of its occurrence in alkaline soils, but have never had opportunity to test the amount of salts tolerated. On account of its annual habit and succulent character, this plant would be excellent for plowing-under. Seed is not on the market and will, we fear, be difficult to obtain.

Halsted, J. M.; Oakland, Alameda County.—Leaf and seeds of what is probably either a true Fumitory (Fumaria sp.) or the Climbing Fumitory (Adlumia cirrhosa), native of the Eastern States, and sometimes cultivated in gardens. Material insufficient for identification.

Hampton, John; Live Oak, Sutter County.—Saponaria vaccaria, L.: A troublesome grain-field weed, naturalized in the Honey Lake Valley, but not previously recorded from the Sacramento Valley.

Hill, Henry A.; Corona, Riverside County.—Three native California Saltbushes: One is Atriplex expansa; the others are incomplete and not in condition for determination. The general opinion among ranchmen has been that most of the native Saltbushes of this class are not of any value as forage plants. A recent letter from Mr. J. R. Bayha, of Clair, Orange County, informs us, however, that the one known as Fog-weed (Atriplex expansa) has some value as hay. No data are as yet available as to its relative value for forage purposes.

Jaffa, M. E.; Berkeley, Alameda County.—Plantago patagonica californica, from a Mr. Cooper in southern California. Said to be eaten and much liked by stock in southern California.

Johnson, E. J.; Superintendent Staten Island Land Co., San Joaquin County.—Bronco-grass (Bromus maximus gussoni), for information as to the best means of eradication. Recommended mowing while the grain is still "in the milk," at which time hay of a medium quality can be made of it. Grazing with stock before "heading out" is also recommended if animals can be induced to eat it, but as a rule stock (cattle at least) decline to do so as long as anything else is available. Bermuda-grass or Knot-grass (Paspalum distichum) might choke it out, but Perennial Ray-grass is not likely to do so.

Josephi, D. E.; Bakersfield, Kern County.—Weeds from a field "in which I have raised canary-seed for the last five years, sowing imported and impure seed each time." The specimens were too immature for accurate determination.

Lee, H. Rowland; Riverside, Riverside County.—A weed, the Red-rooted Galingale (Cyperus erythrorhizus), a native aquatic sedge. This plant is of no known economic value and has never, heretofore, been considered a dangerous weed. We can scarcely tell, however, what it may not become under the favorable conditions produced by irrigation.

Lyell, M. R.; Alvarado, Alameda County.—Alkali plants from Lancaster, Los Angeles County (Mojave Desert plateau): 1. Tussock-grass (Sporobolus airoides); 2. Salt-grass (Distichlis spicata); 3. Kochia (Kochia californica); 4. Samphire (Salicornia); 5. Scrub Saltbush (Atriplex polycarpa and A. confertifolia). These plants generally indicate the presence of strong alkali salts.

McArthur, Dr. J. M.; Isabella, Kern County.—Rhamnus crocea var. ilicifolia, for information as to habits, abundance, and medicinal properties. This shrub is a relative of the celebrated Rhamnus californica, the Cascara sagràda of the Spanish-Californians. The botanists of the State Geological Survey record that "the ripe berries are much used by the Indians for food, and their veins are said to become tinged by a deposition of the red coloring matter." We have no record of the plant having any other value. The family Rhamnaceæ is characterized principally by its cathartic properties; the foliage is often somewhat bitter and astringent, and the flesh and juice of the fruit are commonly mawkish or nauseous. Rhamnus crocea ilicifolia is found in the Coast Range Mountains from Mount Diablo southward, but appears to be more abundant in the Sierra Nevada. We doubt whether it ever occurs in sufficient quantity to become a predominant feature of the vegetation. Dr. McArthur states that it is largely used by the Piute Indians as a cathartic and diuretic, and is called by them "hopeimbah."

Mitchell, L. J.; Fowler, Fresno County.—1. Vinegar-weed (Trichostema lanceolatum); 2. Turkey Mullein (Eremocarpus setigerus); 3. Eriogonum gracile. All three plants are generally found in, and their presence may be taken to indicate, a light, sandy soil free from alkali, at least near the surface.

Morrison, Miss; Berkeley, Alameda County.—Three garden plants: Amaryllis belladonna, the Belladonna Lily of South Africa; Bouvardia sp., a horticultural variety or hybrid, probably from Mexico; and Brunfelsia hopeana, of Brazil.

Myers, Dr. H. C.; Berkeley, Alameda County.—Alkali weeds characteristic of certain beet-lands in Utah: 1. Bigelovia graveolens, Gray, common in alkali soils from Dakota to British Columbia and south to southern California and New Mexico; 2. Bigelovia douglasii serrulata, Gray, common throughout the whole dry interior region; 3. Salsola kali tragus (Russian Thistle), an introduced and cosmopolitan weed and therefore one that can scarcely be considered necessarily indicative of the presence of alkali; 4. An Atriplex, not in condition for determination.

Orum, G. L.; Rio Vista, Solano County.—Lythrum hyssopifolium, a weed which has come up in new-sown alfalfa, for the first time this year. It is a native of Europe and not recorded as having proven troublesome as a weed. The seeds are distributed by means of irrigation.

Osterhout, Dr. W. J. V.; Berkeley, Alameda County.—Quercus agrifolia, Nee.; Quercus californica, Cooper; Quercus chrysolepis, Lieb.; Erysimum asperum, DC.; Calochortus albus, Dougl.; Pyrola aphylla, Smith; Rubus parviflorus var. velutinus (Brewer), Greene; Cestrum (Habrothamnus) newelli, Hort.; Iris florentina and I. germanica × squalens; Horehound (Marrubium vulgare, L.), family Labiatæ. Horehound is a native of Europe, naturalized as an escape from gardens, and becoming a troublesome weed; known as "White Man's foot," on account of the rapidity with which it follows the footsteps of civilization. It is used in domestic medicine as a remedy for coughs and colds, either as a tea or in the form of cough drops.

Pacific Rural Press; San Francisco.—Crab-grass (Panicum sanguinale), from Napa County, where it has become troublesome in a lawn. Crab-grass is an annual, and can usually be eradicated by persistent and thorough hand-pulling, taking care to destroy the plants before the seed matures, or better before the plants head out. It is a very troublesome weed in Eastern lawns and in fields of the Cotton States.

Pease, C. J.; Olema, Marin County.—Scarlet Larkspur (Delphinium nudicaule), a plant which is not uncommon in the Coast Range Mountains from the Santa Lucia Mountains to Napa Valley and northward.

Pratt, Chas. F.; Fallbrook, San Diego County.—Calandrinia menziesii. Mr. Pratt asks if it is of use as a green-manure. It is a common weed and is useful for plowing-under in so far as it supplies humus to the soil, but it is not a nitrogen-gatherer like the Leguminosæ.

Rikey, Daniel; Oakland, Alameda County.—A species of Grindelia (probably Grindelia cuneifolia). It has long been known in materia medica under the name of Grindelia. It is believed that G. cuneifolia and other species are now largely used in substitution for the original G. robusta, as a remedy for poison oak.

Rimpau, Frank T.; Los Angeles.—Eriogonum fasciculatum, Benth. Mr. Rimpau reports that he has found through personal experience that the plant is beneficial in cases of grippe, hoarseness, and bronchitis.

Ryan, R. M.; Gilroy, Santa Clara County.—Red Oxalis (Oxalis corniculata atropurpurea, Planch.), a troublesome lawn weed. The plant can be exterminated through a persistent effort to root out each new individual before it forms any seed, not letting a single new seed escape; but as this is a slow and tedious process, it might be found more profitable to remove all the earth from the lawn to a depth of 9 or 12 inches, and replace it with good, fresh loam. We know of no application which would destroy the weeds and kill their dormant seeds without injuring the grass and rendering the soil sterile for some time.

Sessions, Miss K. O.; San Diego.—Eucalyptus siderophloia, var. rostrata. This striking variety has not hitherto been known in cultivation in California. Miss Sessions reports that it "grows very erect, withstands winds well, also the drought to a remarkable degree."

Shinn, C. H.; Berkeley, Alameda County.—Atriplex angulata and A. halimoides.

Shipley, Dr. Wm. C.; Hodson, Calaveras County.—Rattlesnake-weed, or Yerba de vibora (Daucus pusillus). "This plant is considered by Indians, Spanish, and mountaineers, an infallible remedy for rattlesnake bites."

Smalley, Robert; Blocksburg, Humboldt County.—Chess or Cheat (Bromus secalinus submuticus). Though it produces a heavy weight of seed, this grass is not known to be of any practical value; it is a grain-field weed, occupying space which should be filled by more valuable plants. It is often stated by the unobservant that Cheat is a degenerate Wheat, but this is not the case. Only Cheat seeds will produce Cheat, and wherever there is Cheat it was preceded by Cheat seeds, which may have been introduced with seed-grains, or brought in by birds or animals from other fields. Cheat and Wheat are not even nearly related plants, but belong to very distinct tribes of the great grass family. It is less probable that Wheat could change into Cheat in a few generations than that Wheat could change into Barley or Rye, which are much more closely related species.

Smith, J. Walter; Watsonville, Santa Cruz County.—Johnson-grass (Andropogon halepensis).

Smith, Jere; Hawkins Bar, Trinity County.—Bronco-grass (Bromus maximus gussoni). A native of South Europe and becoming a troublesome weed in California. It is considered that the awns or beards are injurious to the mouth, eyes, and ears of animals, though we do not know of any case of injury actually traceable to this cause. The grass is said to be of but little agricultural value, as stock appear to dislike it at all stages of its growth. It has been found that by cutting when in the same stage that barley is cut for hay (that is, when the heads are green and soft), it makes hay of fair quality. If it has not gone too far, we should advise to eradicate the plant from the ranch. As the plant is an annual of shallow-rooting habit, it can be readily destroyed, while there is little of it, by cutting or pulling before the heads mature. Along the coast, this grass is said to be eaten readily by stock, when dead ripe and after it has been softened and moistened by heavy fogs.

Stearns, Elmer; Los Angeles.—Seeds of Gingko biloba.

Stein, M. P. & Co.; Stockton, San Joaquin County.—Ears of a grain, raised by Mr. D. H. Loveland from four kernels given him by "a man who hailed from the north, and who told him that he got it from some extreme northern point, not stating where." From these four kernels Mr. Loveland raised something like four sacks after two years of planting it on his land near Waterloo. "It is a very rank grower, and stools very heavily, and will lodge very easily with heavy spring rains." This is the Polish Wheat (Triticum polonicum, L.), known also as Jerusalem, Mogador, Roman, or Cairo Wheat, or Polish, Ukrania, Astrakan, or African Rye (though it is not a rye). It is said to have come originally from southeastern Asia, and is successfully cultivated in southern Siberia and other parts of Asia, Africa, southern France, and Spain. In northern Europe it is only grown as a spring wheat, as it will not tolerate much frost or excessive moisture. In Africa it is grown for ensilage, and the grain is said to make an excellent gruel.

Stiles, Harvey C.; Horticultural Manager, Maywood Colony, Corning, Tehama County.—Lupinus polycarpus, Greene. Mr. Stiles reports that "there are acres of it, fairly matting the ground and having excrescences very profusely." This species is undoubtedly an excellent one for green-manuring purposes, whenever there is enough of it to make a good crop.

Van Winkle, Mrs. H. E.; Ferndale, Humboldt County.—Wild Mustard (Brassica), with inquiry as to the best method of eradication from fields. Hand-pulling is undoubtedly the best and in the end the cheapest method of eradication; mowing usually induces branching from the base of the stem and more profuse seeding, and on account of the lower stature of the new shoots they are often not seen when a second mowing is attempted.

Wheeler, John C.; Long Beach, Los Angeles County.—Australian Saltbush (Atriplex semibaccata) and Pig-weed (Chenopodium murale): Of the latter he reports that "it is green all over this section where most vegetation is dead and dry. Has it a value as feed for stock or chickens?" We are not aware that it is ever eaten by livestock of any kind.

Miscellaneous Plants Sent In.—Amarantus albus, L. (Tumble-weed), reported as poisonous to sheep. We have no record of this plant being injurious, and it is not likely to possess poisonous properties. It is conceivable, however, that it might impact in the stomach and thus cause mechanical injury.—Polygonum aviculare: Sent in with the report that it had proven poisonous to sheep. It is not likely that this plant is the cause of poisoning, as poisonous principles are not known to occur in the genus, nor, indeed, in the family.—Mesembryanthemum edule (Hottentot fig), of South Africa.—Memorandum on the culture of Anise (Pimpinella anisum).—Bromus willdenowii hænkeanus, from Independence, Inyo County. This is a form of the valuable forage grass (Bromus willdenowii) which is somewhat extensively cultivated in the Southern States as a forage grass on account of its drought-resisting qualities and early winter growth. Rescue-grass usually dies after once seeding, but frequent mowing or close grazing will prevent it from going to seed and prolong its life over a period of two or three years, or even more.—Paspalum distichum, L. (Knot-grass), from Three Rivers, Tulare County. This is a sub-tropical species which is thoroughly at home on flooded lands, but will not stand drought. It makes excellent grazing, and is a good plant for binding levees and washed soils.—Iris variegata, of southern Europe.

CLIMBING PLANTS FOR CALIFORNIA.

The following answers in regard to climbing plants were given to a letter of inquiry from Prof. B. D. Halstead, of the New Jersey Experiment Station:

1. What is your best vine for brick and stone walls?—Ampelopsis veitchii.

2. Do you have the Virginia Creeper (Ampelopsis quinquefolia) wild in abundance, and is it made use of for fence and house coverings?—It is not wild in this State, but is used not infrequently for houses, trellises, and training on tree trunks.

3. Do you make use of the climbing Honeysuckles (Lonicera), and do they hold their green foliage all winter unprotected?—The Japanese

Honeysuckle (L. japonica) is most frequently seen; it remains green all winter without protection.

4. Is the Virgin's Bower (Clematis) a native with you, and is it used for trellises, or the Japanese C. paniculata and the Jackman class of large-flowered hybrids?—Clematis ligusticifolia and C. lasiantha are natives here, but not cultivated. C. montana and the Jackmanni types are favorites for trellis work.

5. Are the Wistarias used in your section satisfactorily?—Yes, especially W. sinensis.

6. Do climbing Roses prove of value for piazza screens?—Yes, the most frequently used of any climbers for this purpose, especially R. banksiæ.

7. Are the climbing Matrimony-Vine, Actinidia and Trumpet Creeper used to any extent?—Not extensively.

8. Kindly mention the ornamental perennial vines generally employed, and in the order of their usefulness?

Roses,
Tacsonia mollissima,
Tacsonia manicata,
Cobæa scandens,
Ipomœa learii,
Clematis jackmannii,
Clematis montana,
Ampelopsis tricuspidata,
Dolichos lignosus,
Lantana camara,
Jasminum officinale,
Heliotropum peruvianum,
Lonicera japonica, var. halliana,
Solanum jasminoides,
Senecio mikanioides,
Muehlenbeckia complexa,
Tecoma radicans,
Tecoma jasminoides,
Bignonia grandiflora,
Hedera helix,
Asparagus medeoloides,
Mandevilla suaveolens,
Araujia sericofera,
Wistaria sinensis,
Plumbago capensis,
Clianthus puniceus,
Boussingaultia baselloides,
Akebia quinata,
Maurandia barclaina,
Lophospermum scandens,
Manettia bicolor,
Sollya heterophylla,
Solanum wendlandi,
Phaseolus caracalla,
Holboellia latifolia,
Periploca græca,
Antigonon leptopus,
Bougainvillea glabra,
Ficus pumila.

DONORS OF SEEDS AND PLANTS TO THE STATION FROM JULY, 1898, TO JUNE, 1901.

By Joseph Burtt Davy.

Adams, Ira W.; Calistoga, Napa County.—April, 1899. Seeds of the "Boss Bean," a cow-pea (Vigna catjang (Lour.), Walp.). 53.*

Adams, T. W.; New Zealand.—October, 1899. Seeds of Carmichælia flagelliformis, Discaria toumatou, Genista spinosa, Panax arboreum, Senecio hectorii, Veronica salicifolia var. 98.

Barteldes, F. & Co.; Lawrence, Kansas. February 26, 1900. Seeds of Paspalum dilatatum, and of the "Kansas Standard" tomato. 36.

Bassler, H. R.; Waterloo, Nebraska.—1901. One packet of seed of "Penicillaria zeaoides," for trial and report. 80.

Berry, C. P.; Wheatland, Yuba County.—November 30, 1898. Seeds of Zizyphus vulgaris, the Jujube, from a twelve-year-old bush growing at Wheatland. 128.

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* The figures affixed to each group are those of the catalogue for that year.

Blasdale, Dr. W. C.; Berkeley, Alameda County.—February 9, 1899. Seeds of Benincasa cerifera, purchased in Chinatown, San Francisco. 17.

Bloom, S.; Mexico.—February 13, 1900. Seeds of Carica papaya. 34.

Brown, D. J.; Lost Camp, Napa County.—January 28, 1901. One packet of seeds of Lupinus albus, imported from Portugal. 14.

Bunnell, J. S.; Berkeley, Alameda County.—April 18, 1901. Seeds of selected varieties of the Artichoke (Cynara scolymus), from Europe.

Burkhalter, Prof. Chas.; Chabot Observatory, Oakland, Alameda County.—April 18, 1900. Seed of a grass from the Dekkan, southern India, which grew in fields where crops had failed from drought. 74.

Buysman, M.; Middleburg, Holland.—1901. Six packets of seeds: Acacia cavenia, Cocos yatai, Canna edulis, Embothrium coccineum, Jubæa spectabilis, Trifolium lupinaster. 51.

February, 1899. Fifteen packets of seeds: Acacia binervata, A. giraffæ, A. cavenia, A. penninervis, A. leiophylla, A. horrida, A. glaucescens, Artabotrys odoratissima, Beaumontia grandiflora, Calendula officinalis, Calotropis gigantea, Coriandrum sativum, Chenopodium quinoa, Desmodium gyrans, and Pimpinella anisum.

Campbell, R.; Foster, San Diego County.—February 17, 1900. Seeds of a forage grass.

Cleland, Miss L. T.; Mesa Grande, San Diego County.—August 11, 1899. Seeds of a species of Galium (?) from high altitudes on the mountains; said to be eaten by stock. 80.

Croll, W.; Kellogg, Sonoma County.—January 3, 1900. Seeds of a wild "Vetch" from Mount St. Helena, said to be eaten by cattle. 2.

Davy, J. Burtt; Berkeley, Alameda County.—December 6, 1898. Seeds of Garvanza, or Spanish Pea (Cicer arietinum). 134.

Demesmay, F.; Cysoing, Nord, France.—October 23, 1898. Seeds of a variety of Poppy known as "Oeillette," which is cultivated at Cysoing for the seeds, from which is expressed an oil, used as a salad oil. 122.

Duffy, J. B.; Galt, Sacramento County.—February 16, 1899. Seed of the "Conch Cow Pea" (Vigna catjang var.). 18.

Edmands, W. O.; Red Hill Ranch, Upper Lake, Lake County.—December 3, 1898. Roots of Paspalum distichum. 135.

Eells, A. B.; West Palmdale, Los Angeles County.—September 19, 1898. Seeds of a native Wild Olive (Forestiera Neo-mexicana). 98.

Fay, Wm. J.; Anaheim, Orange County.—April 18, 1900. Seeds of a native Lupin, for trial as a green-manure crop. 81.

Ferris, John W.; San Francisco.—February 6, 1900. Seed of Puccinellia maritima, from the salt-marshes of San Mateo; said to be a valuable forage plant. 18.

Franceschi, Dr. F.; Santa Barbara.—March 1, 1900. Seeds of Acacia cavenia and Indigofera anil; roots of Salpichroa rhomboidea. 30.

January, 1899. Seeds of Ocimum basilicum, Indigofera anil, Acacia penninervis, and Hunnemannia fumariæfolia. 2.

January 31, 1900. Seeds of Polygala apopetala, Brandegee, from Lower California. 13.

Fryer, Prof. John; Berkeley, Alameda County.—December, 1898. Seed of a Millet cultivated in China. 139.

Gilmore, J. W.; Wu Chang, China.—April 11, 1900. Two packets of seed: "Wu Tung" and "Yang Wu Tung." 73.

Hughes, F. R.; Cordoba, Argentina.—February 1, 1900. Seeds of "Quebracho colorado" (Loxopterygium lorentzii, Griseb.) and "Quebracho blanco" (Aspidosperma quebracho, Griseb.), two valuable tannin-producing trees of Argentina. 14.

Lemmon, J. G.; Oakland, Alameda County.—October 2, 1899. Seeds of Abies magnifica. 104.

Livermore, C. W.; Pasadena, Los Angeles County.—One packet of seed of Giant Rose Paprica, imported from Hungary.

Melde, Henry; Eureka, Humboldt County.—August 19, 1899. Seeds of "New Blue Sweet Pea" (Lathyrus sativus, var. cœruleus). 76.

Minister of Agriculture; Buenos Ayres, Argentina.—September 6, 1899. Seed of Atriplex cachiyuyum, a new forage plant of Argentina. 78.
May 26, 1900. Seeds of Acacia cavenia, Atriplex spongiosa, Cocos yatai, Chenopodium quinoa, Gourliea decorticans, Oxalis tuberosa, Machærium tipa, Salpichroa rhomboidea. 102.

Museum d'Histoire Naturelle; Paris, France.—March 23, 1900. Nine packets of seed: Agrimonia officinalis, Aristotelia maqui, Chenopodium quinoa, Carex divulsa, Cocos yatai provincialis, Eragrostis pilosa, Fragaria chiloensis, Holcus lanatus, Salpichroa rhomboidea. 53.
January, 1899. Seeds of Artemesia annua. 12.

Naudin, Prof. Ch.; Villa Thuret, Antibes, France.—1899. Four packets of seed: Cucurbita sp. (Courge patate), Pittosporum tenuifolium, Schinus terebinthifolius, and Zornia diphylla. 5.

Oxnard, Robt.; San Francisco.—1900. Seeds of Pistacia vera, imported from southern Europe. 161.

Reeves, H. R.; Alameda, Alameda County.—February 6, 1900. Seed of Sechium edule, the Chayote of Mexico. 17.

Royal Botanical Gardens; Kew, England.—January 6, 1900. Tubers of Oxalis crenata. 120.

Royal Botanical Gardens; Peradenya, Ceylon.—May 18, 1900. Seeds of Indigofera anil and Pachyrhizus tuberosus.

Samen-Control Station; Zurich, Switzerland.—April 3, 1900. Five packets of seed: Arrhenatherum avenaceum bulbosum Carex arenaria, Carex divulsa, Eragrostis pilosa, Festuca spadicea. 62.

Sander, F. & Co., Nurserymen; St. Albans, England.—December, 1898. Case of living plants, shipped free of charge, containing: Acalypha godseffiana, Acalypha sanderi, Dracæna godseffiana, twelve bulbs of Eurycles amboinense, six bulbs of Hæmanthus kalbreyeri, twenty-six new varieties of Rex begonia, Tacsonia militaris. 136.

Smith, E. M.; Kenwood, Napa County.—December, 1898. Seed of Broomcorn Millet (Panicum miliaceum). 137.

Sperling, Chr.; Middletown, Lake County.—January, 1900. Roots and seed of "Festuca altissima," said to be a good forage grass and to have been distributed originally from this Station. 1.

Sutton & Sons, Seedsmen; Reading, England.—October, 1899. Twenty packets of seed of selected varieties of grasses and forage plants: Achillea millefolium, Giant Perennial White Clover, Giant Hybrid Cow Clover, Cynosurus cristatus, Mammoth Long Red Mangel, Yellow Globe Mangel, Medicago lupulina, Large Guernsey Parsnip, Annual or Common Ray-grass, Pacey's Perennial Ray-grass, Sutton's Dwarf Perennial Ray-grass (Lolium perenne suttoni), Sutton's Selected Perennial Ray-grass, Sutton's Ordinary Perennial Ray-grass, Imported Italian Rye-grass, Sutton's Giant Evergreen Italian Ray-grass, Ordinary Italian Ray-grass, Trifolium pratense perenne. 96.

Toumey, Prof. W. J.; Agricultural Experiment Station, Tucson, Arizona.—October 28, 1898. Seeds of Vitis arizonica, collected at Fort Lowell, near Tucson, A. T., September 30, 1898. 116.

Also seeds of the same from a four-year-old vine grown at the Experiment Station farm at Phœnix; "the seeds from which this vine was raised came from Tucson." 117.

Trumbull & Beebe; San Francisco.—December 6, 1898. Sixty-five packets of grass seed imported from Le Coq & Co., Darmstadt, Germany. 132 and 150.

Nine packets of seed of Chinese Millets.

U. S. Department of Agriculture; Washington, D. C.—May 18, 1900. Three packets of seeds of forage grasses: Poa pratensis, Poa læviculmis, Poa nevadensis. One packet of seed: Bassia dallachyana. 86.—One packet of seed: Melaleuca leucadendron. 87.—Four packets of seeds: Colocynth, No. 3986; Juniper, No. 2172; Staphysagria, No. 2126; also No. 3360. 88.—One packet of seed: "Sevilla Long Pod," from Naples, Italy, No. 4352. 89.—Three packets of seeds: No. 4354, Neapolitan, from Naples; No. 4353, Sicilian, from Naples; No. 4351, Aquadulce, from Naples. 90.—One packet of seed: No. 3141, Pistacia, from Italy. 92.

March 26, 1900. Seed of Opuntia ficus-indica inermis, No. 4570. 49.

April 3, 1900. Twenty-six packets of seeds of grasses and other forage plants for arid regions. 61.

March 19, 1900. Twelve packets of seeds: Abutilon mitchelli, No. 4302; Bassia dallachyana, No. 4306; Bauhinia carronii, No. 4296; Eleusine cruciata (= E. ægyptiaca), No. 4304; Eremophila maculata, No 4299; E. longifolia, No. 4298; E. duttonii, No. 4303; Enchylæna tomentosa, No. 4287; Heterodendron oleæfolium, No. 4295; Myoporum montanum, No. 4300; Pittosporum phillyræoides, No. 4297; Tribulus hystrix, No. 4301. 68.

March 19, 1900. Nine packets of seeds: Acacia sentis, No. 4305; Atriplex halimoides, No. 4293; Atriplex kochiana, No. 4294; Atriplex angulata, No. 4292; Kochia aphylla, No. 4288; K. brevifolia, No. 4287; K. pyramidata, No. 4291; K. villosa, No. 4290; Rhagodia hastata, No. 4386. 71.

April 11, 1900. Four packets of seeds: Bean from France, No. 2377; Broad Beans from France, No. 2375 (destroyed, because full of weevils);

Garbanzo (Chick Pea) from France, No. 2376; Sorghum, "Edgar," No. 4312. 72.

February 28, 1900. Single seed of the Wax Palm, No. 1986. 28.

Ninety-seven packets of Eucalyptus seed; twenty-one packets of miscellaneous economic seeds. Eucalyptus sp. Nos. 325 to 3264, inclusive, 3266, 3268, 3317, 3318, 1604, 1611, 1614, 1615, 1618, 1619, 1620, 1622, 1626, 1632, 1634, 1636, 1637, 1638, 1640, 1641, 1642, 1645, 1647, 1649, 1650, 1653, 1655, 1656, 1657, 1658, 1659, 1671, 1672, 1673, 1674, 1675, 1676, 1677, 1680, 2985, 2987, 2988, 2989, 1607, 1608, 1609, 1610, 1612, 1617, 1621, 1623, 1624, 1625, 1629, 1633, 1635, 1639, 1643, 1644, 1646, 1651, 1652, 1654, 1660, 1662, 1663, 1664, 1670, 1672, 1675, 1678, 1679, 1325. 38.

Bixa orellana, No. 1845; Callitris arborea, No. 1326; Callistemon sp.; Elæagnus sp., No. 1200; Festuca elatior, No. 1180; Hæmatoxylon campechianum, No. 1890; Lathyrus sativus, No. 1175; Mucuna utilis, No. 1262; Panax quinquefolium; Stachys sieboldii; Vicia faba, Nos. 1453, 1455, 2064, 2066, 2375, 2978, 2994, 3628, 3761; Vicia villosa, No. 3769; Vitex, No. 1694; Zizyphus sp., Nos. 1195 and 1203; Zizyphus sativa, No. 1164.

Four packets of seeds: Acacia horrida, No. 1805; Acacia receana, No. 1834; Callitris arborea, No. 1326; Callistemon sp. 39.

Seed of Eucalyptus paniculata, No. 1656; E. pilularis, No. 1657; E. piperita, No. 1658; E. planchoniana, No. 1659; E. pressiana, No. 1660; E. punctata, No. 1661; E. sp., No. 1662; E. raveretiana, No. 1663; E. redunca, No. 1664; E. regnans, No. 1665; E. resinifera, No. 1666; E. risdonii, No. 1667; E. robusta, No. 1968; E. rostrata, No. 1669; E. rudis, No. 1671; E. rudis rostrata, No. 1672; E. saligna, No. 1673; E. siderophloia, No. 1674; E. sieberiana, No. 1675; E. stuartiana, No. 1676; E. tereticornis, No. 1677; E. viminalis, No. 1680; E. sp. Algeria, Nos. 2985, 2987, 2988, 2989; E. acmenoides, No. 1604; E. calophylla, No. 1611; E. coccifera, No. 1614; E. diversicolor, No. 1615; E. cornuta, No. 1618; E. corymbosa, No. 1619; E. corynocalyx, No. 1620; E. crebra, No. 1622; E. ficifolia, No. 1626; E. obliqua, No. 1630; E. gomphocephala, No. 1632; E. goniocalyx, No. 1634; E. gunnii, No. 1636; E. hæmastoma, No. 1637; E. hemiphloia, No. 1638; E. cornuta, No. 1640; E. leucoxylon, No. 1641; E. longifolia, No. 1642; E. macrorrhyncha, No. 1645; E. marginata, No. 1647; E. melliodora, No. 1649; E. microcorys, No. 1650; E. obliqua, No. 1653; E. occidentalis, No. 1655. 40.

March 26, 1900. Twenty-six packets of seeds from Naples: Fennel, "Largest of Sicily," No. 4367; Fennel, "Prince Bismarck," No. 4368; Fennel, "Bolognese," No. 4370; Sweet Fennel, No. 4484; Sweet Fennel, No. 4485; Fennel, "Morosini," No. 4369; Vegetable Marrow, No. 4365; Vegetable Marrow, No. 4366; Broccoli, No. 4355; Broccoli, "Sta. Teresa," No. 4356; Broccoli, No. 4357; Broccoli, "San Martinari," No. 4358; Broccoli, "Geunarese," No. 4359; Chow Broccoli, No. 4482; Chow Broccoli, No. 4483; Chard, "Swiss Silver-ribbed," No. 4361; Chard, "Chilian Yellow," No. 4364; Chard, "Chilian Scarlet," No. 4363; Chard, "Curled Silver-ribbed," No. 4362; Asparagus, "Chicory," No. 4360; Nos. 4345, 4347, 4348, 4350. 47.

March 23, 1900. Two packets of seeds of Melons: Citrullus vulgaris, No. 4269; Cucumis melo, No. 3945. 48.

March 26, 1900. Twenty packets of seeds of Eucalyptus from Algeria: Nos. 3259, 3260, 3261, 3262, 3263, 3264, 3265, 3266, 3267, 3251, 3252, 3250, 3253, 3254, 3255, 3256, 3257, 3258, 3317, and 3318. 50.

November, 1899. Seed of Ginseng (Panax quinquefolia), No. 3938. 115.

January, 1900. Seed of "Koonia" (Peucedanum sp.), a forage plant from the mountains of Persia. 12.

February, 1900. Tubers of Stachys sieboldi (these had commenced to rot badly, on arrival, and none lived). 15.

April 21, 1899. Seeds of Polygonum (No. 2804) and Verbena bracteosa from Yakima, Washington. 54 and 55.

May 2, 1899. Roots of Poa macrantha and Carex macrocephala from Astoria, Oregon. 57.

October, 1899. Seeds of Hilaria cenchroides and H. mutica. 97.

December, 1900. Three rooted clumps of Panicum maximum. Thirteen packets of seed of forage and green-manure plants from arid regions of Tunis and Algeria. Two packets of seeds: Aspidosperma quebracho and Loxopterygium lorentzii. One packet of seed of Sesamum indicum. Living plants of Carex macrocephala and Poa macrantha. 171.

June 4, 1900. Eighteen packets of seeds: Caper, No. 3006; Caradunine, No. 3547; Deubeutonia tripetii; Okra, No. 3632; Kafir Corn, No. 4624; Field Pea, No. 1486; Partridge Pea, No. 1487; Pistacia, No. 3135; Polygala butyracea, No. 5074; Papaya, No. 5112; Pithecolobium dulce, No. 657; Quinoa, No. 3073; Quillaja, No. 3360; Sapindus, No. 3483; Spondias, No. 3080; No. 5126; Terebinth, No. 3149; Melia azedirachta. 105.

Van Tubergen, C. G.; Haarlem, Holland.—One packet of tubers of Tropæolum edule.

Vilmorin, Andrieux & Cie; Paris, France.—March 12, 1900. Rooted plants of Festuca spadicea, Salpichroa rhomboidea, and Fragaria chilensis. 42.

Watkins, J. M.; Grizzly Flat, El Dorado County.—February 15, 1899. Roots of three varieties of seedling strawberries, selected from some fourteen varieties raised by him from seed and fruited for the past two seasons. 23.

Watts, Francis; Government Laboratory for the Leeward Islands, Antigua, B. W. I.—October 26, 1899. Seed of Chloris barbata, a forage grass, for trial on alkali soils. 114.

In addition to the above, extensive collections of valuable seeds, chiefly of forage and green-manure plants, have been received through the Department of Botany by exchange of seeds (raised in the Botanical Garden of the University) with Botanical Gardens and Experiment Stations in all parts of the world.

The influx of seeds during the past four years has been enormous—in fact, more than the Station could possibly handle with its limited force. Much of the seed has failed to germinate, on account of age or poor quality. Much has, however, been made use of, especially that of the green-manure and forage plants. The Eucalypts and Acacias have been propagated at the Santa Monica Forestry Station.

EXCHANGES.

Seeds and plants have been received by exchange during the two years ending June 30, 1902, as follows:

Adlam, R. W.; Joubert Park, Johannesburg, South Africa: 1 packet Gerbera jamesonii.

Agri-Horticultural Society, Madras, India: 14 packets.

Agricultural Experiment Station, Laramie, Wyoming: 1 packet.

Argotti Botanical Gardens, Floriana, Malta: 8 packets.

Botanical Gardens, Amsterdam, Holland: 5 packets.

Botanical Gardens, Bukarest, Roumania: 19 packets.

Botanical Garden, Geneva, Switzerland: 84 packets.

Botanical Garden, Hamburg, Germany: 101 packets.

Botanical Garden, Harvard University: 41 packets.

Botanical Gardens, Kew, England: 125 packets.

Botanical Gardens, Kingston, Jamaica: 1 packet seed of Euterpe edulis, 1 packet seed of Tectona grandis, 1 packet seed of Desmodium gyrans, and 4 packets of other seeds.

Botanic Garden, Melbourne, Australia: 65 packets.

Botanic Garden, Mount Holyoke College, South Hadley, Mass.: 12 packets.

Botanical Gardens, Palermo, Italy: 34 packets.

Botanic Garden of the University, Prague, Bohemia: 24 packets.

Botanic Garden (Imperial), St. Petersburg, Russia: 75 packets.

Botanic Gardens (University), St. Petersburg, Russia: 25 packets.

Botanic Gardens, Sibpur, Calcutta, India: 187 packets.

Botanic Garden, Smith College, Northampton, Mass.: 34 packets.

Botanic Gardens, Sydney, N. S. W., Australia: 118 packets.

Botanic Garden, Imperial University, Tokyo, Japan: 41 packets.

California Nursery Co., Niles: 6 plants of Eucalyptus sideroxylon rosea.

Cornu, Prof. Maxime; Museum d'Histoire Naturelle, Paris, France: Living plants of 11 species.

Dall, James; Collingwood, New Zealand: 33 packets.

Department of Agriculture, Buenos Ayres, South America: 16 packets.

Department of Agriculture, Western Australia: 50 packets.

Hanbury, Comme. Thos.; La Mortola, Italy: 23 packets.

Jardin Alpin d'Acclimatation, Geneva, Switzerland: 73 packets.

Laboratoire de Botanique, Grenoble, France: 12 packets.

Museum d'Histoire Naturelle, Paris, France: 20 packets.

Sapporo Agricultural College, Sapporo, Japan: 42 packets.

Sprenger, Cavalier C.; Vomero, Naples, Italy: 120 packets.

Thorburn, J. M. & Co.; New York, N. Y.: 13 packets.

Thornber, Prof. J. J.; Tucson, A. T.: Seeds of 5 species of Atriplex.

Vilmorin, Andrieux & Cie; Paris, France: 19 packets.

THE LIBRARY AND READING-ROOM OF THE CENTRAL EXPERIMENT STATION.

NEWSPAPERS, MAGAZINES, AND PERIODICALS RECEIVED, JULY, 1902

CALIFORNIA.

Berkeley Daily Gazette, Berkeley, Alameda County.
Oakland Enquirer, Oakland, Alameda County.
Amador Dispatch, Jackson, Amador County.
Oroville Register, Oroville, Butte County.
Chico Enterprise, Chico, Butte County.
Colusa Sun, Colusa, Colusa County.
Fresno Weekly Republican, Fresno, Fresno County.
Willows Journal, Willows, Glenn County.
Inyo Register, Bishop, Inyo County.
Inyo Independent, Independence, Inyo County.
Lake County Bee, Lakeport, Lake County.
California Cultivator, Los Angeles, Los Angeles County.
California Fruit-Grower, Los Angeles, Los Angeles County.
Fruit World, Los Angeles, Los Angeles County.
Rural Californian, Los Angeles, Los Angeles County.
L'Union Nouvelle, Los Angeles, Los Angeles County.
Pomona Weekly Times, Pomona, Los Angeles County.
Pomona Progress, Pomona, Los Angeles County.
Pasadena Weekly Star, Pasadena, Los Angeles County.
Madera Mercury, Madera, Madera County.
Marin Journal, San Rafael, Marin County.
Dispatch-Democrat, Ukiah, Mendocino County.
Mendocino Beacon, Mendocino, Mendocino County.
Merced Express, Merced, Merced County.
Salinas Index, Salinas, Monterey County.
Gonzales Tribune, Gonzales, Monterey County.
St. Helena Star, St. Helena, Napa County.
Napa Register, Napa, Napa County.
Weekly Tidings-Telegraph, Grass Valley, Nevada County.
Press and Horticulturist, Riverside, Riverside County.
Citrograph, Redlands, San Bernardino County.
Chino Valley Champion, Chino, San Bernardino County.
Weekly Times-Index, San Bernardino, San Bernardino County.
Colton Chronicle, Colton, San Bernardino County.
Imperial Press, Imperial, San Diego County.
Escondido Times, Escondido, San Diego County.
Weekly Post, San Francisco.

Weekly Chronicle, San Francisco.
Weekly Call, San Francisco.
Weekly Examiner, San Francisco.
California Demokrat (German), San Francisco.
California Fruit-Grower, San Francisco.
United States Weather Report, San Francisco.
Wood and Iron, San Francisco.
Pacific Rural Press, San Francisco.
Dairy and Produce Review, San Francisco.
Department of Public Health, San Francisco.
Deutsche Vereins-Zeitung, San Francisco.
Pacific Wine and Spirit Review, San Francisco.
Western Creamery, San Francisco.
San Miguel Messenger, San Miguel, San Luis Obispo County.
San Luis Obispo Breeze, San Luis Obispo, San Luis Obispo County.
Times-Gazette, Redwood City, San Mateo County.
Weekly Press, Santa Barbara, Santa Barbara County.
Gilroy Gazette, Gilroy, Santa Clara County.
Pacific Tree and Vine, San José, Santa Clara County.
Pajaronian, Watsonville, Santa Cruz County.
Dixon Tribune, Dixon, Solano County.
Vacaville Report, Vacaville, Solano County.
Santa Rosa Republican, Santa Rosa, Sonoma County.
Petaluma Poultry Journal, Petaluma, Sonoma County.
Healdsburg Tribune, Healdsburg, Sonoma County.
Oakdale Graphic, Oakdale, Stanislaus County.
Yreka Journal, Yreka, Siskiyou County.
Sutter County Farmer, Yuba City, Sutter County.
Corning Observer, Corning, Tehama County.
The New Era, Corning, Tehama County.
The Maywood Colony Advocate, Corning, Tehama County.
Weekly Tulare Register, Tulare, Tulare County.
Tulare County Times, Visalia, Tulare County.
Porterville Enterprise, Porterville, Tulare County.
Visalia Delta, Visalia, Tulare County.
Santa Paula Chronicle, Santa Paula, Ventura County.
Ventura Free Press, Ventura, Ventura County.
Winters Express, Winters, Yolo County.

OTHER STATES.

Florida Times-Union and Citizen, Jacksonville, Florida.
Southern Farmer, Athens, Georgia.
Farm, Field, and Fireside, Chicago, Illinois.
Farm and Home, Chicago, Illinois.
Orange Judd Farmer, Chicago, Illinois.
Elgin Dairy Report, Elgin, Illinois.
Prairie Farmer, Chicago, Illinois.
Farmer's Voice, Chicago, Illinois.
Farm and Fireside, Chicago, Illinois.
The Dairy and Creamery, Chicago, Illinois.
The Sugar-Beet Gazette, Chicago, Illinois.
National Farmer and Stock-Grower, National Stock-Yards, Illinois.

Breeders' Gazette, Chicago, Illinois.
The Milk News, Chicago, Illinois.
Hospodarske Listy (Russian), Chicago, Illinois.
Urban and Rural America, Quincy, Illinois.
Farmers' Advance, Chicago, Illinois.
Woman's Home Companion, Springfield, Illinois.
The Chicago Livestock World, Chicago, Illinois.
Chicago Daily Drovers' Journal, Chicago, Illinois.
Up-to-Date Farming and Gardening, Indianapolis, Indiana.
Jersey Bulletin, Indianapolis, Indiana.
Indiana Farmer, Indianapolis, Indiana.
Agricultural Epitomist, Indianapolis, Indiana.
Farmers' Guide, Huntington, Indiana.
Dubuque Trade Journal, Dubuque, Iowa.
Homestead, Des Moines, Iowa.
The Farmers' Tribune, Des Moines, Iowa.
Kansas Farmer, Topeka, Kansas.
Louisiana Planter, New Orleans, Louisiana.
Rural Topics, Morgan City, Louisiana.
Turf, Farm and Home, Waterville, Maine.
Sanitary Inspector, Augusta, Maine.
Baltimore Weekly Sun, Baltimore, Maryland.
Southern Farm Magazine, Baltimore, Maryland.
The Ruralist, Glückheim, Maryland.
The Trade, Baltimore, Maryland.
Farm Poultry, Boston, Massachusetts.
American Cultivator, Boston, Massachusetts.
New England Farmer, Boston, Massachusetts.
North American Horticulturist, Monroe, Michigan.
The Modern Farmer, St. Joseph, Missouri.
Western Fruit-Grower, St. Joseph, Missouri.
The Republic, St. Louis, Missouri.
Edward's Fruit-Grower and Farmer, Missoula, Montana.
Farmer (German), Lincoln, Nebraska.
Mirror and Farmer, Manchester, New Hampshire.
New Hamphire Farmer and Weekly Union, Manchester, New Hampshire.
New Mexico Review, Sante Fé, New Mexico.
Vick's Magazine, Rochester, New York.
American Agriculturist, New York City, New York.
Jersey Advocate and Dairyman, New York City, New York.
New York Produce Review, New York City, New York.
Rural New Yorker, New York City, New York.
The Country Gentleman, Albany, New York.
Agricultural Advertising, Chicago and New York.
American Wine Press, New York City, New York.
Bonfort's Vine and Spirit Circular, New York City, New York.
The Strawberry Culturist, Kittrell, North Carolina.
American Grange Bulletin, Cincinnati, Ohio.
The Ohio Farmer, Cleveland, Ohio.
Bulletins of the Lloyd Library, Cincinnati, Ohio.
The Agricultural Student, Ohio State University, Columbus, Ohio.
The Northwest Pacific Farmer, Portland, Oregon.

Oregon Agriculturist, Portland, Oregon.
The American Fertilizer, Philadelphia, Pennsylvania.
Germantown Telegraph, Germantown, Pennsylvania.
Public Ledger, Philadelphia, Pennsylvania.
Practical Farmer, Philadelphia, Pennsylvania.
The Sugar Beet, Philadelphia, Pennsylvania.
Successful Farmer, Sioux Falls, South Dakota.
Texas Farm and Ranch, Dallas, Texas.
Texas Stockman, San Antonio, Texas.
Holstein-Friesian Register, Brattleboro, Vermont.
The Southern Planter, Richmond, Virginia.
Northwest Horticulturist, Tacoma and Seattle, Washington.
Port Orchard Independent, Washington.
West Virginia Farm Review, Charleston, West Virginia.
Hoard's Dairyman, Fort Atkinson, Wisconsin.
Flour and Feed, Waukegan, Wisconsin.

FOREIGN.

The Agricultural Journal, Cape Town, South Africa.
The Agricultural Journal and Mining Record, Maritzburg, South Africa.
Bulletin Agricole, Algiers, Africa.
Bulletin de la Direction de l'Agriculture et du Commerce, Tunis, Africa.
Report of the Government Entomologist, Natal, South Africa.
Agricultural Gazette, New South Wales, Adelaide, Australia.
Annual Reports, Department of Agriculture, Victoria, Australia.
The Australian Garden and Field, Adelaide and Melbourne, Australia.
The Hawkesbury Agricultural College Magazine, Richmond, N. S. W., Australia.
Journal of Agriculture and Industry of South Australia, Adelaide, Australia.
The Journal of the Department of Agriculture of Victoria, Australia.
Journal of the Department of Agriculture of West Australia, Perth, Australia.
Queensland Agricultural Journal, Brisbane, Australia.
S. F. D., The Station, Farm and Dairy, Sydney, N. S. W., Australia.
Jahresbericht Samen-Control-Station, Vienna, Austria.
Tiroler Landwirtschaftliche Blätter, S. Michele, Tirol, Austria.
Bulletin de la Station Agronomique de l'Etat a Gembloux, Brussels, Belgium.
Boletim da Agricultura, Sao Paulo, Brazil, South America.
The World, Vancouver, Canada.
Maritime Farmer, Sussex, N. B., and Truro, N. S., Canada.
Bulletin de la Chambre d'Agriculture, Saigon, Cochin China.
Journal of the Khedivial Agricultural Society and School of Agriculture, Cairo, Egypt.
Memoranda of the Rothamsted Experiments, Rothamsted, England.
Bulletin de la Société Nationale d'Acclimatation de France, Paris, France.
Journal d'Agriculture Tropicale, Paris, France.
La Grele, Station Viticole de Villefranche, France.

Bulletin de la Société des Viticulteurs de France, Paris, France.
Pomologie Française, Lyon, France.
La Semaine, Paris, France.
Atti della Reale Accademia, Firenze, Italy.
Bollettino Technico, Scafati, Italy.
L'Agricoltore Calabro-Siculo, Catania, Italy.
Italian bulletins, Palermo, Italy.
Bulletins of Vittoria peglion, Rome, Italy.
Rivista Meteorico-Agraria, Rome, Italy.
Agri-Horticultural Society of Madras, India.
Planting Opinion, Madras, India.
Mededeelingen uit' slands Plantentuin, De Zoogdieren Van Java, Batavia, East Indies.
Landwirtschaftliche Presse, Berlin, Germany.
Notizblatt des Königl. botanischen Gartens und Museums zu Berlin, Germany.
The Agriculturist, Tokyo, Japan.
Bulletin of the College of Agriculture, Tokyo Imperial University, Japan.
Insect World, Gifu, Japan.
El Agricultor Mexicano, C. Juarez, Chil., Mexico.
Boletin de Agricultura Mineria e Industrias, Mexico.
Boletin de la Comision de Parasitologia Agricola, Mexico.
Boletin Meterologico, Toluca, Mexico.
Bulletins of the Department of Agriculture, Sydney, N. S. W., Australia.
Torreon Enterprise, Coahuila, Mexico.
Department of Agriculture, New Zealand.
Report of Secretary of Agriculture, Nova Scotia.
Archivo Rural, Lisbon, Portugal.
Report of the Department of Agriculture, Brisbane, Queensland.
Annales de L'Institut agronomique, Moscow, Russia.
Boletin de Agricultura, San Salvador.
Reports of the West Scotland Agricultural College, Glasgow, Scotland.
Boletin de la Oficina Agricola Ganadera, Buenos Ayres, South America.
Köngl. Landtbruks-Akademiens Handlingar och Tidskrift, Stockholm, Sweden.
Annuaire agricole de la Suisse, Berne, Switzerland.
Agricultural Gazette, Hobart, Tasmania.
West Indian Bulletin, West Indies.
The Shamba, Journal of Agriculture for Zanzibar.

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SYNOPSIS OF METEOROLOGICAL OBSERVATIONS AT BER

University of California—Students' Observato

Latitude, north 37° 52′ 23″.6. Longitude, west from Greenwich, 122° 15′ 40″.8. Height of cistern of barometer above sea, 320 feet.

	JULY.		AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.		
BAROMETER.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.
Mean barometer for the month		29 952		29.954		30.006		29.994		30.051		30.137	
Highest barometer for the month	12th, 8 A. M.	30.109	12th, 8 A. M.	30.050	12th, 8 A. M.	30.120	31st, 8 A. M.	30.274	30th, 8 A. M.	30.283	20th, 8 A. M.	30.511	8th, 8
Lowest barometer for the month	2d, 8 P. M.	29 831	17th, 8 A. M.	29.804	14th, 8 P. M.	29 819	10th, 8 A. M.	29.627	21st, 8 A. M.	29.648	15th, 8 A. M., 20th, 8 P. M.	29.785	2d, 8
Monthly range		0.278		0.246		0.301		0.647		0.635		0.726	
Highest daily average	12th	30.099	12th	30.022	10th	30.076	16th	30.243	30th	30.248	20th	30.474	8th
Lowest daily average	2d	29.849	17th	29.838	14th	29.845	10th	29.633	21st	29.757	15th	29.827	2d
THERMOMETER.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.	
Mean temperature of the month (F.)		57 3		58.4		56.8		55 8		53.9		46.5	
Mean temperature of the warmest day	9th	64 0	22d, 23d	62.5	3d	59.9	8th	76.5	13th	60.0	11th	54.0	2d
Mean temperature of the coldest day	15th	54.1	30th, 31st	56.0	22d	54.0	13th	48.3	22d	47.5	28th	38.5	23d
Maximum temperature	9th	79.0	21st, 22d, 23d	78.0	13th	77.0	8th	94.0	13th	65.2	24th	61.0	17th
Minimum temperature	29th	42.0	21st	51.2	17th	50.0	15th	45.0	23d	43.2	28th	34.5	23d
Monthly range		36.8		26.8		27.0		49.0		22.0		26.5	
Greatest daily variation	8th	29.3	21st	26.8	13th	24.7	8th	31.0	2d	15.6	24th	17.5	8th
Least daily variation	28th	7.0	5th	6.3	28th	9.1	19th	3.5	28th	3.0	11th	3.3	1st
Mean daily range of temperature		16.1		13.3		15.8		14.3		9.2		11.4	
Mean lowest temperature of the month		52.2		54.5		53.0		51.3		50.7		42.6	
Mean highest temperature of the month		68.3		67.8		68.8		65.6		59.9		54.0	
PRECIPITATION.		Inches.		Inches.		Inches.		Inches.		Inches.		Inches.	
Rainfall during the month		0.000		0.000		0.000		5.255		5.864		3.457	
Rainfall since July 1, 1899		0 000		0.000		0.000		5.255		11.119		14.576	
Rainfall during same period last year		0.000		0.043		0.969		2.846		3.819		5.037	
Dew and fog during month		0 004		0.000		0 008		0.018		0.010		0.013	
Dew and fog since July 1, 1899		0.004		0.004		0.012		0.030		0.040		0.053	
Dew and fog during same period last year		0.000		0.000		0.006		0.017		0.055		0.079	
RELATIVE HUMIDITY.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.	
Mean relative humidity of the month		86.7		86.1		89.6		83.1		90.4		86.5	
Greatest daily variation	10th	15.8	14th	24.2	13th	19.0	2d	15.8	16th	26.0	4th	31.5	10th
Least daily variation	3, 18, 26	1.2	5, 9, 29	00.0	12th and 14th	00.0	11, 12, 20, 21, 28	00.0	4th	0.00	11th and 30th	00.0	14, 1
Maximum humidity	13th, 8 A. M.	100.0	6, 10, 8 A. M.	97.0	15th, 8 A. M.	97.6	30th, 8 P. M.	97.0	9, 10, 27, 28, 8 P. M.	97.0	8, 16, 18 and 29, 8 A. M.	96.0	3d an
Minimum humidity	10th, 8 P. M.	67.0	23d, 8 A. M.	64.0	13th, 8 P. M.	75.0	8th, 8 A. M.	51.0	16th, 8 A. M.	65.0	5th, 8 A. M.	61 0	24th,
Monthly range		33.0		33.0		22.6		46 0		32.0		35.0	
WEATHER.													
Number of clear days		6		7		5		8		4		10	
Number of fair days		10		6		16		12		9		10	
Number of cloudy days		15		18		9		11		17		11	
Total		31		31		30		31		30		31	
Of the total number there were:													
Foggy days		11		9		19		6		5		2	
Days on which rain fell		0		0		0		9		15		12	
WIND OBSERVATIONS.													
Direction of prevailing wind		S. W.		S. W.		S. and S. W.		S.		S.		S.	

AT BERKELEY, FOR THE YEAR ENDING JUNE 30, 1900.

ts' Observatory: ARMIN O. LEUSCHNER, Director.

Compiled by JAMES D. MADDRILL.

	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.		FOR YEAR ENDING JUNE 30, 1900.	
nches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.
30.137		30.131		30.142		30.022		29.996		29.993		29.957		30.028
30.511	8th, 8 A. M.	30.331	21st, 8 A. M.	30.390	9th, 8 A. M.	30.294	10th, 8 A. M.	30.173	6th, 8 A. M.	30.160	16th, 8 A. M.	30.123	Dec. 20th, 8 A. M.	30.511
29.785	2d, 8 A. M.	29.668	6th, 8 P. M.	29.824	22d, 8 P. M.	29.818	20th, 8 P. M.	29.710	10th, 8 P. M.	29.814	30th, 8 P. M.	29.777	Oct. 10th, 8 A. M.	29.627
0.726		0.663		0.566		0.476		0.463		0.346		0.346		0.884
30.474	8th	30.295	21st	30.373	9th	30.245	10th	30.156	6th	30.157	16th	30.081	Dec. 20th	30.474
29.827	2d	29.755	6th	29.881	22d	29.849	20th	29.726	10th	29.846	30th	29.817	Oct. 10th	29.633
egrees.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.
46.5		48.4		49.9		52.0		52.1		57.7		59.8		54.1
54.0	2d	56.5	20th and 22d	54.0	8th	55.8	23d	56.0	29th	63.0	17th, 30th	65.0	Oct. 8th	76.5
38.5	23d	42.2	4th	45.0	4th	46.5	8th	47.3	11th	52.8	2d	53.3	Dec. 28th	38.5
61.0	17th	59.8	24th	65.5	12th	68.5	23d	70.0	11th	81.2	28th	79.5	Oct. 8th	94.0
34.5	23d	39.0	8th	40.0	28th	42.5	8th	39.8	27th	45.5	1st, 2d	50.2	Dec. 28th	34.5
26.5		20.8		25.5		26.0		30.2		35.7		29.3		59.5
17.5	8th	16.5	5th	21.0	29th	20.5	27th	24.0	11th	33.2	5th	26.4	May 11th	33.2
3.3	1st	2.5	18th	5.8	8th, 14th	6.0	30th	4.2	6th	9.2	13th	7.0	Jan. 1st	2.5
11.4		9.8		12.9		13.2		14.6		18.9		16.0		13.7
42.6		45.2		45.2		48.1		46.9		51.0		54.2		49.6
54.0		55.0		58.1		61.3		61.5		69.9		70.2		63.3
nches.		Inches.		Inches.		Inches.		Inches.		Inches.		Inches.		Inches.
3.457		4.178		1.025		3.004		1.584		0.917		0.075		
14.576		18.754		19.779		22.783		24.367		25.284		25.359		25.359
5.037		10.942		11.159		24.351		25.913		27.612		27.662		27.662
0.013		0.035		0.008		0.013		0.001		0.001		0.002		
0.053		0.088		0.096		0.109		0.110		0.111		0.113		0.113
0.079		0.082		0.134		0.154		0.165		0.168		0.186		0.186
Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.
86.5		91.0		87.1		90.4		86.4		84.2		83.9		87.1
31.5	10th	17.0	5th	38.5	26th	13.0	26th	17.0	16th	11.8	28th	21.5	Feb. 5th	38.5
00.0	14, 15, 21, 30, 31	00.0	20th	00.0	4th, 19th	00.0	17th, 24th, 25th	00.0	5th, 21st, 22d, 31st	00.0	7th, 12th, 23d	00.0	Frequently	00.0
96.0	3d and 10th, 8 A. M.	100.0	5th, 8 P. M.	97.0	8th, 31st, 8 A. M., 27th, 8 P. M.	97.0	30th, 8 A. M.	97.0	8th, 10th, 8 A. M., 3d, 4th, 8 P. M.	94.0	22d, 8 A. M.	94.0	Jan. 3d, 10th, 8 A. M.	100.0
61.0	24th, 8 A. M.	75.0	5th, 8 A. M.	58.5	26th, 8 P. M.	80.0	27th, 8 A. M.	58.0	26th, 28th, 8 P. M.	71.0	28th, 8 P. M.	62.0	Oct. 8th, 8 A. M.	51.0
35.0		25.0		38.5		17.0		39.0		23.0		32.0		49.0
10		5		9		8		8		13		5		88
10		12		11		8		9		9		14		126
11		14		8		15		13		9		11		151
31		31		28		31		30		31		30		365
2		9		4		11		4		1		7		88
12		7		7		8		7		6		1		72
S.		S.		N. and N. E.		S.		S.		S. and S. W.		S. and S. W.		

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J:

SYNOPSIS OF METEOROLOGICAL OBSERVATIONS AT BER

University of California—Students' Observatory

Latitude, north 37° 52′ 23″.6. Longitude, west from Greenwich, 122° 15′ 40″.8. Height of cistern of barometer above sea, 320 feet.

	JULY.		AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.		
BAROMETER.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date
Mean barometer for the month		29.901		29.970		29.952		30.008		30.021		30.142	
Highest barometer for the month	23d, 8 A. M.	30.129	21st, 8 A. M.	30.197	28th, 8 A. M.	30.147	29th, 8 A. M.	30.229	30th, 8 A. M.	30.295	4th, 8 A. M.	30.277	12th,
Lowest barometer for the month	14th, 8 P. M.	29.714	25th, 8 A. M.	29.754	23d, 8 P. M.	29.610	10th, 8 P. M.	29.725	20th, 8 P. M.	29.486	14th, 8 A. M.	29.802	3d, 8
Monthly range		0.415		0.443		0.537		0.504		0.809		0.475	
Highest daily average	23d	30.108	21st	30.174	28th	30.120	30th	30.216	30th	30.267	4th	30.256	12th
Lowest daily average	14th	29.735	30th	29.776	23d	29.667	11th	29.739	20th	29.519	14th	29.949	3d
THERMOMETER.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.	
Mean temperature of the month (F.)		60.3		60.4		60.3		56.2		53.9		48.1	
Mean temperature of the warmest day	11th	64.5	1st	69.2	21st	75.0	8th	63.3	12th	66.0	20th	58.3	16th
Mean temperature of the coldest day	17th	54.5	16th	56.4	25th	54.8	29th	49.5	19th	47.0	31st	37.7	1st
Maximum temperature	11th	81.9	1st	87.4	21st, 22d	92.0	8th	82.0	12th	77.7	2d	61.0	16th,
Minimum temperature	12th	51.5	8th	52.0	25th	50.6	29th	44.3	22d, 23d	42.7	31st	34.5	1st
Monthly range		30.4		35.4		41.4		37.7		35.0		26.5	
Greatest daily variation	11th	28.9	1st	32.4	27th	28.2	7th, 8th	26.2	12th	20.7	27th	20.0	19th
Least daily variation	29th	9.0	14th	5.9	12th	5.0	19th	3.9	25th	3.3	16th	5.6	21st
Mean daily range of temperature		17.5		14.4		15.8		13.7		11.7		10.8	
Mean lowest temperature of the month		54.4		55.4		56.0		52.2		49.9		44.2	
Mean highest temperature of the month		71.9		69.8		71.8		65.9		61.6		55.0	
PRECIPITATION.		Inches.		Inches.		Inches.		Inches.		Inches.		Inches.	
Rainfall during the month		0.000		0.015		0.050		1.412		5.038		1.826	
Rainfall since July 1, 1900		0.000		0.015		0.065		1.477		6.515		8.341	
Rainfall during same period last year		0.000		0.000		0.000		5.255		11.119		14.576	
Dew and fog during month		0.004		0.000		0.029		0.021		0.077		0.011	
Dew and fog since July 1, 1900		0.004		0.004		0.031		0.054		0.131		0.142	
Dew and fog during same period last year		0.004		0.004		0.012		0.030		0.040		0.053	
RELATIVE HUMIDITY.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent		Per Cent.	
Mean relative humidity of the month		83.0		84.5		80.5		85.7		87.5		86.5	
Greatest daily variation	24th	33.5	1st	16.0	20th, 22d	35.0	7th	17.0	3d	24.0	28th	16.0	31st
Least daily variation	2d	0.0	7th	0.0	7, 9, 11, 25, 30	0.0	4th, 16th	0.0	1st, 16th, 19th	0.0	31st	0.5	6th,
Maximum humidity	29th, 8 P. M.	97.0	14th, 8 A. M.	94.0	8th, 8 A. M.	91.0	1st, 31st, 8 A. M.	97.0	3d, 5th, 8 A. M.	97.0	19, 8 A.M.; 12, 8 P.M.	97.0	4, 8 A
Minimum humidity	24th, 8 P. M.	53.0	2d, 8 P. M.	75.0	22d, 8 A. M.	45.0	2d, 8 A. M.	70.0	12th, 8 P. M.	62.0	27th, 8 P. M.	59.5	31st,
Monthly range		44.0		19.0		46.0		27.0		35.0		37.5	
WEATHER.													
Number of clear days		12		10		16		15		11		14	
Number of fair days		11		15		8		5		10		10	
Number of cloudy days		8		6		6		11		9		7	
Total		31		31		30		31		30		31	
Of the total number there were:													
Foggy days		6		3		2		0		0		2	
Days on which rain fell		0		1		4		11		9		4	
WIND OBSERVATIONS.													
Direction of prevailing wind		S. W. and S.		S.		S.		S. E.		S. and S. E.		E. and S. E.	

T BERKELEY, FOR THE YEAR ENDING JUNE 30, 1901.

servatory: Armin O. Leuschner, Director.

Compiled by James D. Maddrill.

	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.		FOR YEAR ENDING JUNE 30, 1901.	
es.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.
42		30.042		30.009		30.070		29.469		29.419		29.898		29.908
77	12th, 8 A. M.	30.343	12th, 8 A. M.	30.359	13th, 8 A. M.	30.344	4th, 8 P. M.	29.670	4th, 8 P. M.	29.601	7th, 8 A. M.	30.046	Feb. 12th, 8 A. M.	30.359
02	3d, 8 P. M.	29.655	8th, 8 A. M.	29.564	10th, 8 P. M.	29.840	28th, 8 P. M.	29.242	24th, 8 A. M.	29.166	24th, 8 P. M.	29.590	May 24th, 8 A. M.	29.166
75		0.688		0.795		0.504		0.428		0.435		0.456		1.193
56	12th	30.330	12th	30.327	12th	30.313	4th	29.637	4th	29.597	13th	30.017	Jan. 12th	30.330
49	3d	29.720	8th	29.592	10th	29.855	29th	29.267	24th	29.193	29th	29.633	May 24th	29.193
es.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.
		47.9		49.5		52.3		51.0		54.7		58.3		54.4
	16th	55.0	28th	60.0	3d	63.3	23d	55.5	31st	62.5	28th	68.0	Sept. 21st	75.0
	1st	38.0	9th	41.0	27th	46.0	3d	44.7	6th, 19th, 20th	51.5	11th, 19th, 20th	54.0	Dec. 31st	37.7
	16th, 27th	59.3	28th	73.2	3d	74.2	9th	69.8	31st	81.2	28th	86.6	Sept. 21st, 22d	92.0
	1st	31.9	9th	35.8	30th	40.4	4th	37.3	18th	43.4	8th	46.3	Jan. 1st	31.9
		27.4		37.4		33.8		32.5		37.8		39.6		60.1
	19th	15.0	26th	18.0	19th	23.7	22d	22.7	31st	29.1	27th	30.9	Aug. 1st	32.4
	21st	4.1	16th	2.8	22d	9.0	2d	6.8	13th	5.9	19th	5.5	Feb. 16th	2.8
		8.8		11.1		15.7		15.8		14.8		20.4		14.2
		44.6		45.6		47.5		45.4		49.3		50.9		49.6
		53.4		56.7		63.2		61.2		64.1		71.3		63.8
s.		Inches.		Inches.		Inches.		Inches.		Inches.		Inches.		Inches.
26		5.849		5.925		0.908		3.049		1.022		0.000		
41		14.190		20.115		21.023		24.072		25.094		25.094		25.094
76		18.754		19.779		22.783		24.367		25.284		25.359		25.359
11		0.000		0.092		0.000		0.011		0.000		0.039		
42		0.142		0.234		0.234		0.245		0.245		0.284		0.284
53		0.088		0.096		0.109		0.110		0.111		0.113		0.113
t.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.
		84.6		87.8		83.4		84.5		87.0		84.1		84.9
	31st	22.0	14th	17.0	2d	36.0	28th	19.0	22d	15.0	12th	9.0	March 2d	36.0
	6th, 13th	0.0	7, 16, 20, 23	0.0	21st, 31st	0.0	10th, 18th	0.0	3, 13, 14, 19, 27, 30, 31	0.0	3, 4, 7, 9, 11, 14, 15, 24, 28	0.0	Frequently	0.0
	4, 8 A. M.; 12, 8 P. M.	97.0	19th, 8 P. M.	100.0	25th, 8 A. M.	97.0	4th, 8 A. M.	96.0	11. 16, 28, 29, 8 A. M.	94.0	17, 8 P. M.; 18, 19, 20, 8 A. M.	94.0	Feb. 19th, 8 P. M.	100.0
	31st, 8 P. M.	64.0	1st, 8 P. M.	66.0	3d, 8 A. M.	53.0	9th, 8 A. M.	69.0	18th, 8 A. M.	73.0	27th, 8 P. M.	74.0	Sept. 22d, 8 A. M.	45.0
		33.0		34.0		44.0		27.0		21.0		20.0		55.0
		12		11		20		18		10		22		171
		7		7		8		4		12		3		100
		12		10		3		8		9		5		94
		31		28		31		30		31		30		365
		0		4		0		1		0		5		23
		13		13		4		6		5		0		70
E.		N. and S. E.		S. E.		N.		S. E.		Calm.		S.		

PUBLICATIONS OF THE AGRICULTURAL EXPERIMENT STATION, UNIVERSITY OF CALIFORNIA.

From 1877 to 1902.

REPORTS.

The following are **not** available for distribution, the supply having been exhausted:

Year Published.	TITLE.
1877.	Reports to the President of the University from the College of Agriculture and the Mechanic Arts. (For 1876–77.)
1879.	Supplement to the Biennial Report of the Board of Regents. (For 1878–79.)
1880.	Supplement No. 1 to the Report of the Board of Regents.
1881.	Report of the Professor in charge to the Board of Regents. (Annual 1880.)
1883.	Report of the Professor in charge to the President. (For 1881–82, also called Biennial Report.)
1884.	Report of the Professor in charge to the President. (Called Biennial Report for 1883 and 1884.)
1886.	Report of the Viticultural Work during the seasons 1883–84 and 1884–85, being Appendix IV to the Report for the year 1884; with notes regarding the Vintage of 1885–86. (This report includes the time between 1882 and 1886.)
1886.	Report of the Viticultural Work during the seasons 1885 and 1886, being Appendix VI to the Report for the year 1886.
1887.	Supplement to the Biennial Report of the Board of Regents. (For 1885–86.)
1888.	Report of Experiments on Methods of Fermentation and Related Subjects during the years 1886–87. Advance sheets from the Annual Report of 1888.
1889.	Report of the Professor in charge to the President. (For 1887–88.)
1889.	Report of Examinations of Waters, Water-supply, and Related Subjects, during the years 1886–89. Advance sheets from the combined reports for 1888 and 1889.
1890.	Report of the Professor in charge to the President for year ending June 30, 1890.
1890.	Report on the Agricultural Experiment Stations of the University of California, with descriptions of the regions represented. Being a part of the combined reports for 1888 and 1889.
1892.	Report of the Viticultural Work during the seasons 1887–89, with data regarding the Vintage of 1890.
1891.	Report of Work of the Agricultural Experiment Station of the University of California for the year 1890.
1892.	Alkali Lands, Irrigation, and Drainage in their Mutual Relations. Appendix to the report for the year 1890.
1893.	Report of Agricultural Experiment Stations of the University of California for the year 1891–92.
1894.	Report of Work of the Agricultural Experiment Stations of the University of California for the year 1892–93 and part of 1894.
1895.	Olives; Pickling Process, Etc. Appendix to the report for 1894–95.
1896.	Report of the Agricultural Experiment Stations for the year 1894–95.

The following **are** available for distribution:

1896.	Report of the Viticultural Work during the seasons 1887–93, with data regarding the Vintages of 1894–95.
1897.	Resistant Vines, their Selection, Adaptation, and Grafting. Appendix to Viticultural Report for 1896.
1898.	Partial Report of Work of Agricultural Experiment Stations for the years 1895–96 and 1896–97.
1900.	Report of the Agricultural Experiment Stations of the University of California for the year 1897–98.

BULLETINS.

The following are **not** available for distribution, the supply having been exhausted:

No. 8. Announcement of Lectures and Sketch of Outdoor Work.
17. Thesis on Utility and Methods of Soil Analysis.
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30. Examination of Various Upland Soils.
31. Examination of Trosseau and Berger Wines.
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38. Investigations of Wines from rare Grape Varieties—Beclan, Cabernet Franc, Cabernet Sauvignon.
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65. Shall California Make Sophisticated Wines?
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67. Misconception of the University Viticultural Work.
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69. Wine Colors and Color Wines.
70. Abnormal Deposits on Vine Leaves; Mysterious Death of Vines; Remedy for the Anthracnose of Vines.
71. The Use of Gases against Scale Insects.
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73. The Use of Hydrocyanic Acid against Scale Insects.
74. Vintage Work and Instruction in the Viticultural Laboratory. The Choice of Resistant Stocks.
75. Spray and Band Treatments for the Codling-Moth. Difficult Fermentation.
76. Distribution of Seeds and Plants.
77. The Extraction of Color and Tannin during Red-Wine Fermentation.
78. Report on the Establishment of Outlying Stations.
79. Experiments on the Cause and Avoidance of Injury to Foliage in the Hydrocyanic Gas Treatment of Trees.
80. Progress of the Experiment Station Work.
81. Distribution of Seeds and Plants.
82. The Lakes of the San Joaquin Valley.
83. The Rise of Alkali in the San Joaquin Valley.
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85. Observation of Olive Varieties.
86. Preservative Fluids for Fresh Fruits. The Sulfuring of Dried Fruits.
87. The Conservation of Wines.
88. The Use of Fertilizers in California.
89. Distribution of Seeds and Plants.
90. Fiber Plants of California.
91. Port and Sherry Grapes in California. Importation of Italian Grapes. Importation of Olives.
92. Notes on California Olives, their Adaptation and Oils.
93. Investigation of California Oranges and Lemons.
94. Composition of the Ramie Plant. Fertilizing Value of Greasewood.
95. Distribution of Seeds and Plants.
96. Sulfuring in Fruit Drying. Fig Trees at the Experiment Stations. Notes on the Persian Palms.
97. Investigation of California Prunes, Apricots, and Peaches.
98. Distribution of Seeds and Plants.
99. Root Knots on Fruit Trees and Vines.
100. Investigation of the Cattle Foods of California.
101. Further Examination of California Prunes, Apricots, Plums, and Nectarines.
102. Analyses of Figs and Fig Soils.
103. Distribution of Seeds and Plants.
104. Investigation of California Olives and Olive Oils.
105. The Canaigre, or Tanner's Dock. Australian Saltbush for Alkali Soils.
106. Distribution of Seeds, Plants, and Scions.
107. The Russian Thistle in California.
108. The Distribution of the Salts in Alkali Soils.
109. Distribution of Seeds and Plants.
110. The Study of Human Foods and Practical Dietetics.
111. The Work of the College of Agriculture.
112. Distribution of Seeds and Plants.
113. The Bleaching of Nuts by Dipping.
114. The Causes of "Frogging" and "Bloating" of Prunes
115. Remedies for Insects and Fungi.
116. The California Vine-Hopper.
117. The Control of the Temperature in Wine Fermentation.
118. Distribution of Seeds and Plants.
119. Vine Pruning.
120. The Olive Knot.
124. Lupins for Green-Manuring.

The following are available for distribution:

No. 121. The Conservation of Soil Moisture and Economy in the Use of Irrigation Water
122. Orchard Fumigation.
123. Olives. (Reprint from Nos. 123 and 137.)
125. Australian Saltbush.
126. Paris Green for the Codling-Moth.
127. Bench-Grafting Resistant Vines.
128. Nature, Value, and Utilization of Alkali Lands.
129. Report of the Condition of Olive Culture in California.
130. Preservation of Unfermented Grape-Must.
131. The Phylloxera of the Vine.
132. Feeding of Farm Animals.
133. Tolerance of Alkali by Various Cultures.
134. Report of Condition of Vineyards in Portions of Santa Clara Valley.
135. The Potato-Worm in California.
136. Erinose of the Vine.
137. Pickling Ripe and Green Olives.
138. Citrus Fruit Culture.
139. Orange and Lemon Rot.
140. Lands of the Colorado Delta in Salton Basin, and Supplement.
141. Deciduous Fruits at Paso Robles.

In addition, the following circulars have been issued:

Distribution of Seeds and Plants.
Seed Bulletins for 1898–99, 1899–1900, and 1901–02.
Brown Rot of Stone Fruits.

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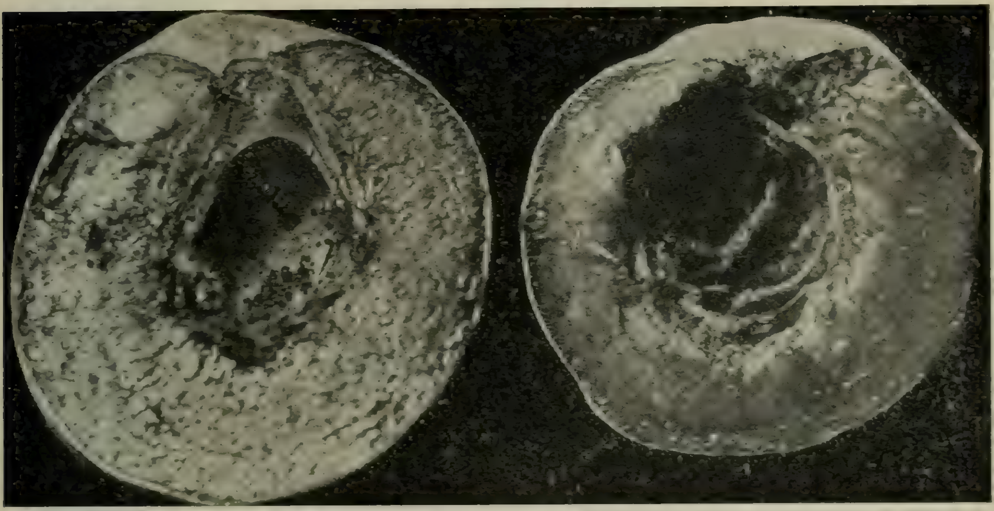
UNIVERSITY OF CALIFORNIA PUBLICATIONS.

COLLEGE OF AGRICULTURE.

AGRICULTURAL EXPERIMENT STATION.

THE PEACH-WORM.

By WARREN T. CLARKE.



The Peach-Worm and its Injury.

BULLETIN No. 144.

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THE PEACH-WORM.

By WARREN T. CLARKE.

Introductory Note.—The investigations reported in this bulletin were undertaken at the request and with the coöperation of the peach-growers of Placer County. At the Farmers' Institutes held last winter at Loomis and Newcastle this Department was urged to help in the fight against the peach-worm.

The work was finally made possible through the agreement, by certain public-spirited gentlemen at Newcastle, to provide for the local expenses of the study. These expenses were finally assumed by the Supervisors to the sum of $330. The University contributed the services of the Assistant Entomologist, W. T. Clarke, who began his work on the 2d of January of the present year, having his headquarters at Newcastle.

Early in February a press bulletin was issued, as a result of this study, recommending a method of treatment which has proven to be remarkably efficient. The majority of growers in Placer County, and doubtless many elsewhere, availed themselves of this information and have already reaped very material benefits.

The people of Placer County have left nothing undone that would aid Mr. Clarke in this study, and this bulletin represents the results of this year's spraying experience of practically the whole acreage of the largest fresh-fruit-shipping section of the State.

Many points in the life history of the peach-worm have been cleared up in this study, and the facts have been found to be in many important particulars at variance with the accounts of the insect heretofore published.

C. W. Woodworth.

Probably the most serious peach pest in California is the peach-worm (*Anarsia lineatella* Zell.), a widely distributed insect, attacking also plums and apricots, but so far as now known, confining its attack to the stone fruits. Its greatest and most evident damage is the injury to the fruit of the peach, grown for Eastern shipment as fresh fruit. In some seasons this loss has aggregated as high as thirty per cent of the entire crop. Some idea of the magnitude of the damage may be gained from the following table, which presents the losses suffered by the growers of fresh fruit alone during the past four years:

Table Showing Loss Due to the Work of the Peach-Worm in Fresh Fruit.

	Not Injured. Shipped.		Injured by Worm. Not Shipped.	
Year.	Carloads.	Value.	Per cent Lost.	Value Lost.
1898	1,103	$661,800	25	$220,000
1899	2,625	1,575,000	20	393,000
1900	1,361	816,600	25	272,000
1901	1,901	1,140,600	30	488,000
Total in four years	6,990	$4,194,000	25	$1,373,000

These figures are, of course, only estimates, but are believed to be safely on the conservative side and understate the actual loss in fruit suffered in the seasons under consideration.

To the aggregate loss shown in this table of over one and one third million dollars, must be added the loss in value of the fruit grown for canning and drying.

The damage done by the insect is by no means confined to the fruit, but great injury is at times also done to the trees themselves. The insect feeds in the spring upon the new growth as soon as it appears, long before the peaches are formed, causing this new growth to die just as it is starting. It is known at this time as the "bud-worm," and its attack has frequently been so severe as actually to cause the death of the infested trees. In parts of California the loss in this way has been in some regions very heavy, but the actual money loss in cases of this kind can hardly be accurately estimated.

In spite of these great losses the peach is considered a very profitable crop in many parts of California, being grown to a considerable extent in the Vaca Valley and adjacent valleys of the foothills of the Coast Range of mountains, in the Santa Clara Valley, and in some of the more favorable portions of the Sacramento and San Joaquin valleys, as well as in the Placer County region, where these investigations were mostly made.

The Placer County peach section, which is probably the best, and certainly largest, green-fruit-producing section in the State, is in the Sierra foothill region, at an elevation of from 600 to 1,200 feet above sea-level. The large proportion of the peach orchards of this section are to be found in the scope of country extending from Auburn on the northeast to Rocklin on the southwest, a distance of fourteen miles along the Central Pacific Railway, and covering the country for from three to ten miles on either side of this railway. Loomis, Penryn, and particularly Newcastle are shipping points in this region.

From the region above described fully ninety per cent of the fresh-peach shipments of the State are made, and the actual loss from the peach-worm here is most clearly felt.

The peach-moth has been long known to entomologists, having been originally described as a European insect in 1839 by C. P. Zeller, in Isis, p. 190. In 1860, Dr. B. Clemens redescribed the moth in Proc. Acad. Nat. Sci., Phil., p. 169, as *Anarsia pruinella,* and in 1872 the same writer identified this insect as the *A. lineatella* of Zeller in "Tineina of North America," p. 36.

Again in 1872, W. Saunders, in Annual Report Entom. Soc. Ontario, p. 15, describes a worm attacking the root and crown of the strawberry, and considers it to be identical with the peach-worm. This belief is shared by other writers, until the work of A. B. Cordley, reported in Bulletin 45, Oregon Agric. Exper. Station, June, 1897, p. 123, made it very probable that the peach-worm and the strawberry crown-borer are distinct insects.

In July, 1872, T. Glover, in Entom. Rec. Monthly Rep., U. S. Dept. Agric., pp. 304–305, reports the peach-worm in Maryland and Virginia.

In 1879, J. H. Comstock, in Rept. U. S. Dept. Agric., p. 255, briefly notes its twig-boring habit and describes the pupation of the second generation on the peach.

The next work of economic importance was that of Edw. M. Ehrhorn, reported by Alexander Craw in Bulletin 67, California State Board of Horticulture, 1893 (1894), page 9; it showed that the insect wintered in the early larval form in chambers hollowed out in the bark of the crotches of the branches of the trees. Mr. Ehrhorn's investigations were continued in 1896–97 by C. L. Marlatt at Washington with material furnished by Mr. Ehrhorn from California, and the results were published in 1898 in Bulletin 10 (new series), U. S. Dept. of Agric., Div. of Entom., pp. 7–20.

The insect has been reported by other writers as being present in Delaware, Illinois, Colorado, and Washington; and doubtless occurs in all peach-growing localities.

The article by Marlatt gives the fullest account of the insect that has yet appeared. This work was unfortunately done under rather unnatural conditions, and does not agree in many instances with the actual orchard habits of the insect here in California. The other Eastern observations were very fragmentary, and required verification here before being of much value as a basis for a scheme of repression.

The writer was somewhat acquainted with the insect from previous studies in the Santa Clara Valley, and from the 2d of January has kept it under continuous observation in breeding-cages, on a large covered tree, and in the orchards in Placer County, particularly about Newcastle, which was headquarters for the investigation. No pains were spared to make the work as exhaustive as possible.

The location of the larger part of the experiments was in an orchard one eighth of a mile southeast of Newcastle, which will be referred to as the *Newcastle station*. Another station was located in an orchard two miles north of Newcastle, which we designate as the *Ophir station;* a third, in an orchard one mile east of Newcastle, known as *station A;* a fourth, in an orchard one and a half miles south of Newcastle, called *station B;* and a fifth, in an orchard three miles northeast of Loomis, and referred to as *station C*. These five places include some two hundred acres of peach trees of many varieties. The number of trees treated in the experiments carried on in these places amount to a total of some 12,000.

The experiments were not confined to these places, however, for work was done in many other orchards. The work done in these other orchards was sufficient to secure some valuable results, and some fourteen of these in which records were kept are reported in the following pages in conjunction with the work and results on the different stations. These other places will be referred to by numbers.

WINTER CONDITIONS, AND WORK OF THE WORM.

The investigation of the peach-worm began by a study of the insect in its winter burrow within the bark, at the crotches of the tree. The position on the tree generally chosen for the purpose is the crotch formed where the new wood joins that of the previous year, though older crotches are occasionally selected. There appears to be something in the physical make-up of the crotch bark that is preferred by the worm for its winter quarters. When the same sort of new bark is formed in other situations, such as that growing over a wound in the older part of the tree, then the worm may also be commonly found in this situation. The position taken in the crotches is that which brings the hibernating chamber invariably on the upper exposure of the limbs. We have never found the burrows on the lower side.

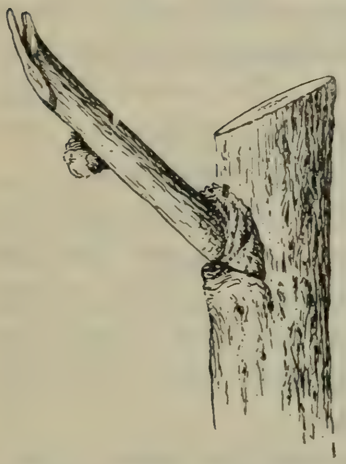

Fig. 1. Twig showing winter burrow, natural size.

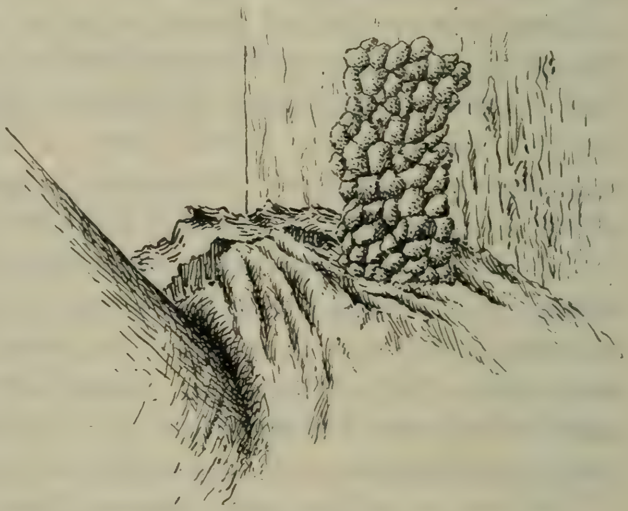

Fig. 2. The same burrow shown in Fig. 1, enlarged.

The location of these burrows may be discovered by the presence of a small mound, which is in reality a silken tube covered with a complete, closely-arranged covering of minute pellets of masticated bark. The color of these pellets on a recently constructed tube is a reddish-brown, of the same shade shown by the bark some hours after it has been cut, and changes to a darker brown after continued exposure to the weather. These mounds are completed in the fall preliminary to the worm's going into winter quarters. They are not added to, nor increased in length, during the winter, even where we have carefully clipped away the tube. Several such uncovered burrows were kept under observation from January 3d to March 5th without any additions being made. The worms on this latter date were removed and found to be alive and apparently healthy. The pellet-covered tubes, shown in natural size in Fig. 1, are rather minute and will usually escape notice. They are quite characteristic in form and are easily recognized in any of their modifications by the aid of a glass, when the bead-like arrangement of the pellets on the tubes, as shown in Figs. 2 and 3, will be noted. The hibernation burrows are cut out well beneath the bark, and extend into the cambium layer. In the majority of cases they are found just beneath a thin layer of the greener cells below the brown bark, while the greater part of the burrow is in the yellowish portion of the cambium. The burrow is generally about three times as large as the worm occupying it, and is lined with silk. The silken tube previously referred to, which projects from the mouth of the burrow, is an extension of this lining. This silk-lined chamber is very efficient as a protection from all inclemencies of the weather, and likewise protects the worm from sprays in a remarkable manner, as will be seen from the experiments detailed later on.

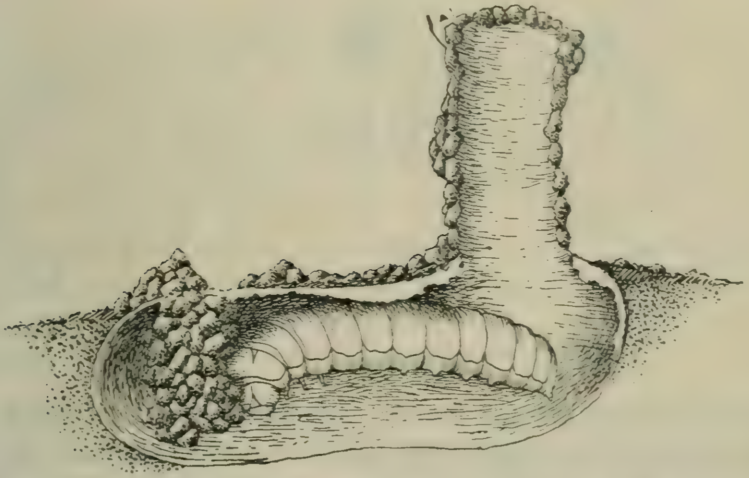

FIG. 3. The same burrow laid open, showing how the worm begins its spring work.

Hibernating Larvæ.—The hibernating larvæ occupying the silk-lined burrows are commonly found at the deep end of the chambers with their heads toward the silken tubes, though they may be found in almost any position. Their age, as they were found in January, is not known, though there was some variation in size and two stages of growth were present, judging by the sizes of the heads. These hibernating worms ranged from 1 to 1½ millimeters* in length. The abdomen and thorax varied in color in different specimens from light brown to white, the head and cervical and anal plates being a shining black, in sharp contrast to the rest of the body. The space between the second and third thoracic segments is noticeably and characteristically lighter in color and more evident than that between any of the other segments. The creature is ornamented with hairs, which spring singly from minute tubercles and which are rather sparsely scattered over it. The general appearance of the larva and the position of the thoracic and abdominal legs are shown, very much enlarged, in Fig. 4. No perceptible change in the size or color of the insect occurred from January 2d until about March 1st.

---

*A millimeter is equal to $\frac{1}{25}$ of an inch.

Parasitism.—The insect was to a slight extent attacked by parasites during the hibernation period, but the amount of benefit derived from this source was extremely small in the Placer County region during the season of 1902. The larvæ of a Proctotrupid fly was found destroying the worms in three different cases, while a predaceous mite, which was probably the same as that mentioned by C. L. Marlatt (Bul. 10, n. s., U. S. Dept. of Agric., Div. of Entom., p. 17) was occasionally noted. The total number of hibernating worms destroyed by these natural enemies was less than one per cent. We were unable, during the season of 1902, to confirm the statement made by Mr. Marlatt in the above-cited publication, that this mite "causes the death of from 75 to 95 per cent of the young larvæ."

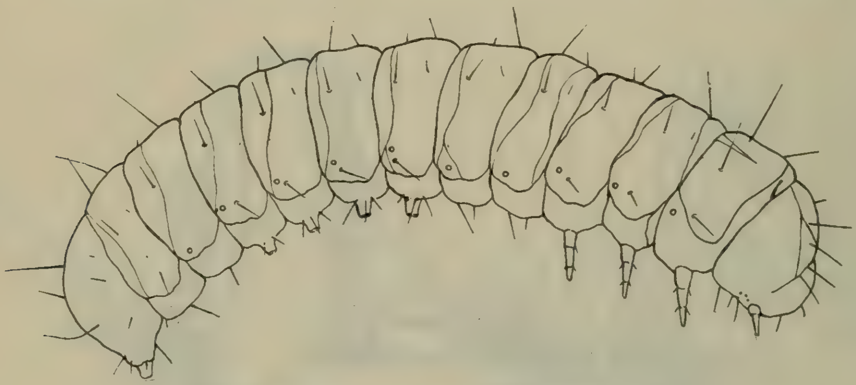

FIG. 4. Wintering larva; much magnified.

DISTRIBUTION OF WORMS IN ORCHARDS.

The distribution of the hibernating worms was very general and uniform over infested orchards, and, except where modified by evident local conditions, the worms were about equally numerous on all the trees. Indeed, as far as hibernation is concerned the variety of the peach seemed of no significance, the worms being found at this season evenly distributed among the early, midsummer, and late trees.

There are some modifying conditions, however, that do result in certain trees being more heavily infested than their neighbors. It is a custom in many orchards to throw out the wormy fruit in piles near the packing-sheds. These sheds are generally placed among the trees, and the piles of rejected wormy fruit are thus usually in close proximity to these trees. It was found that where this custom prevailed these neighboring trees were much more heavily infested than were the rest of the trees in the orchard. This condition is illustrated by the accompanying diagram (Fig. 5), which is of a packing-shed and orchard in the district under investigation. The trees in this orchard are five years old, strong and healthy, but the fruit the previous season was very wormy. The trees generally in this orchard had from five to eight hibernating larvæ in them when investigated.

The distribution here had been very plainly affected by the local conditions. A similar state of affairs was found to be present wherever similar conditions exist.

In certain orchards it has been the habit to distribute the wormy, unmarketable fruit about the less vigorous trees as a fertilizer. It was found that these trees were infested from five to ten times as heavily as the rest of the orchard.

The practice of allowing the wormy fruit to remain in such a condition that the worms may fully develop and carry on the infection could be easily avoided by covering the piles with earth, when the heat developed by fermentation would be sufficient to destroy the worms.

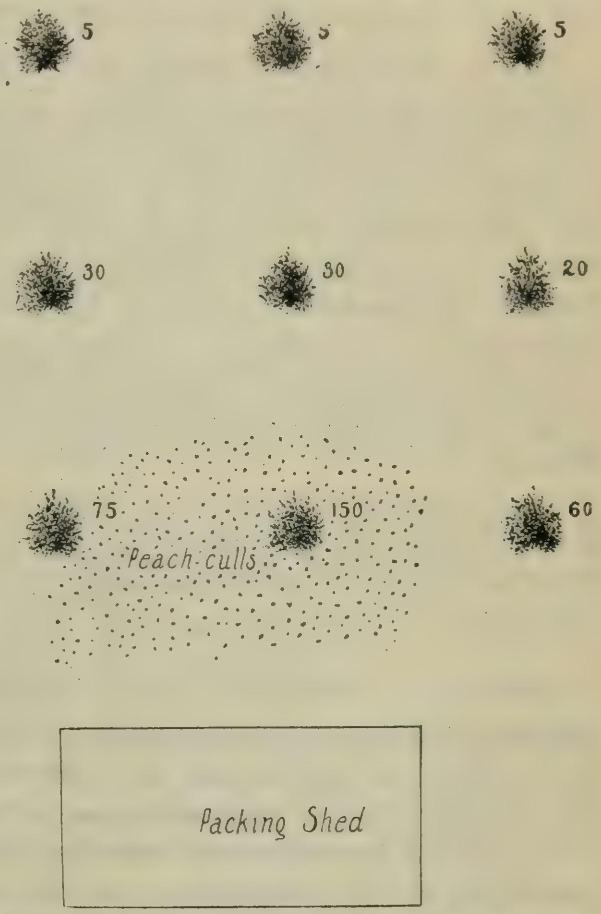

FIG. 5. Diagram of a portion of an orchard showing abundance of worms on trees near cull pile.

PRUNING AS A CONTROL MEASURE.

Some have supposed that in the process of pruning, many of the worms in their winter quarters were destroyed. The percentage of the worms so destroyed, however, is usually very small, as we have determined in many cases by actual count. This counting of the hibernating chambers in trees before and after the pruning showed, on an average, that generally one worm in ten was cut away. As the prunings are removed from the orchard and destroyed the hibernating worms in them are effectually disposed of, but the destruction of only ten per cent is not a very good degree of efficiency.

No great dependence can therefore be placed in the ordinary pruning as a control for the peach-worm.

WINTER SPRAYING EXPERIMENTS.

The practice usually advised for fighting the peach-worm is to spray the trees in the same way as for scale insects. The field work, therefore, began by an attempt to find the best spraying material for this purpose. A series of experiments was undertaken, with the idea of determining the practicability of killing the insect at this time. These experiments began January 9th, and were continued until past the middle of the month. Kerosene emulsion was the first material tried. The emulsions were made up according to the following formulæ:

1st. 150° kerosene, 1½ pints; sour milk, 1 pint; water, 2 gallons.

2d. ¼ pound hard soap dissolved in 2 quarts of water and 1 pint of kerosene.

Each of these emulsions was diluted with two gallons of water, and infested trees were thoroughly sprayed with these mixtures; but to our surprise, when the worms were examined, to ascertain the results of the treatments, no effect whatever was observable.

Resistance to Penetration.—Upon the failure of the above experiments we began a study in the laboratory. In order to test the penetration of these substances under the most severe conditions, we submerged in the emulsion twigs containing the worms and kept them there two days. When the twigs were taken out after this soaking for forty-eight hours, the worms were found none the worse for the experience. That there might be no doubt as to the killing power of the emulsions used, the material was sprayed on several worms with an atomizer, and these worms were dead in from forty-five minutes to one hour and fifteen minutes. The lime, salt and sulfur spray was experimented with, with exactly the same results; showing the same lack of power to penetrate to the worm in its winter home, but killing readily when it was applied to its unprotected body. The same results were also obtained with the distillate oil (28°) and a number of other sprays used. This whole series of experiments indicated the futility of attacking the worm while the winter conditions prevailed, at least under the conditions found in Placer County.

Winter Spraying.—Notwithstanding the fact that our experiments had indicated the comparative futility of winter spraying as a control for the peach-worm, we made careful observations on the few orchards that were sprayed at this time with the lime, salt and sulfur. The conditions found on these places were similar in character. They were all strongly infested with the hibernating larvæ. The spray material was, in each case, carefully prepared and applied to the trees; the effort being made to cover them completely, so that the treatments should be as effective as possible. The poor results of these sprayings will be seen in the tables on pages 33 to 35, orchards Nos. A, C, 1, 7, 8, 9, and 10. Smaller experiments at the Newcastle station, made so as to keep the trees under closer observation, gave exactly similar results.

Besides this work with the lime, salt and sulfur, we sprayed, early in February, six trees (three Hales and three Salways) at the Newcastle station with kerosene oil emulsified with soap in the proportion of 1 part of the emulsion to 8 parts of water on one tree of each of these two varieties; the same emulsion in the proportion of 1 to 10 on two of the other trees, and a mechanical mixture of kerosene oil 1 part to water 3 parts on two more trees.

And also at the Ophir station we sprayed, in the middle of February, forty-eight Salway peach trees with the so-called Hercules emulsion of 28° distillate oil, using the proportions 1 part of emulsion to 8 parts and to 12 parts of water.

In all of these experiments no differences between the sprayed and the checked trees could be distinguished. The account of the ultimate condition is given on page 35.

EXPERIMENTS WITH THE ACTIVE WORM.

Artificially-Induced Activity.—The fact having become thus evident that any work done toward killing the hibernating worm must be delayed, at least until the beginning of the period of its activity, we endeavored to ascertain when this activity could be expected to occur. Branches containing hibernating larvæ were placed with their cut ends in moist sand in a room in which the day temperature was kept at 70° Fahr. and the night temperature fell to about 40° Fahr. They were examined from time to time, and by the end of the fourth day an appreciable activity was noted on the part of the worms. Upon opening their burrows at this time they were found to be quite lively in their motions. At the end of the sixth day the worms had begun to tear away the covering portion of the silk lining to their winter homes. On the fourteenth day worms began to come to the surface, and continued to do so for three days, when they had apparently all come out.

To arrive at the effect of continued warm conditions, a number of the chips containing winter larvæ were cut from the trees. The chips were kept steadily at about the body temperature of the experimenter. The effect of this treatment was rapid, as in one case worms had worked their way out of their burrows at the end of the fourth day, and the longest time taken to emerge was six days.

Considering that it was possible that the worms might be brought forth from the winter quarters by exceptional warm temperature conditions occasionally occurring during the winter, some of the worms were kept under observation after they had come to the surface, to determine if they would, in the absence of green food, re-imbed themselves. A number of these worms, and also a number that had been cut from their burrows, were placed upon fresh uninfested twigs, and their actions noted. During the first twenty-four hours the worms were all more or less active and restless, moving about a great deal, but with no apparent definite object. They became less active during the second twenty-four hours, but made no effort that could be recognized as an attempt to make new burrows. A progressively diminished activity continued during the third twenty-four hours and during the remainder of the time of the experiment, the worms finally dying without re-entering the bark. This experiment was carried on in duplicate, one set being under natural temperature conditions, and the other in a room where the temperature varied between day and night from about 70° Fahr. to about 40° Fahr. The results were the same in both sets. These experiments would seem to indicate that if continued warm weather prevailed during the winter, numbers of the worms might come to the surface, and in the lack of the necessary food would perish.

Experiments in Penetrability.—A series of experiments as to the penetrability of the winter quarters of the worms, after the worms had become active under the influence of an elevated temperature, was now undertaken. The sprays were the same as those previously described, and the work and the results are shown in the following tables:

TABLE SHOWING EFFECTS OF SPRAYS ON WINTER QUARTERS OF THE WORM.

Spray Used.	Effects at End of—			
	1 hour.	2 hours.	3 hours.	4 hours.
	After 6 Days of High Temperature.			
Kerosene and milk emulsion	Alive	Alive, feeble	Feeble	Dead
Kerosene and soap emulsion	Alive	Alive, feeble	Dead	-----
Distillate emulsion	Alive	Alive, feeble	Dead	-----
Lime, salt and sulfur	Alive	Alive, feeble	Dead	-----
	After 8 Days of High Temperature.			
Kerosene and milk emulsion	Alive	Alive, feeble	Dead	-----
Kerosene and soap emulsion	Alive	Alive, feeble	Dead	-----
Distillate emulsion	Alive, feeble	Dead	-----	-----
Lime, salt and sulfur	Alive, feeble	Dead	-----	-----

The results obtained in these experiments seemed definite enough to prove that spraying operations against the peach-worm, to be successful, should be delayed until such time as the worm became active. Growers were therefore advised to delay their spraying operations until the worm had eaten out of its winter nest upon the coming of the warm-weather conditions of spring.

SPRING CONDITIONS AND WORK.

The next stage in the investigation was the planning and carrying-out of extensive field tests, based on the observations and experiments just described.

SPRAYING EXPERIMENTS.

The experiments undertaken at this time were of two classes—those with lime, salt and sulfur mixture, and those with oils and emulsion. Of the former there was a large series under the direct supervision and control of the writer, and a much larger amount of spraying was done by farmers in accordance with our advice. Fully eighty per cent of the spraying done in Placer County this year was timed according to these directions.

In the orchards of the five stations established for this study some 12,000 bearing peach trees were sprayed with the lime, salt and sulfur compound. As full records as possible were kept of the spraying in the whole region where the investigation was made, which amounted to over two million trees which received this same treatment.

Spraying was done at this time on five different places with the I X L compound, a proprietary preparation quite widely advertised. These places, which will be referred to as Nos. 2, 3, 4, 5, and 6, were treated with the compound named, following the exact directions given for the work by the manufacturers. The material was first applied just as the buds were bursting, and this was followed by another application about one month later. Altogether some 8,300 peach trees were sprayed on these five places with this compound. A close watch was kept on these orchards, for it was felt that if the material, which contains lime, salt and sulfur, would control the worm, the fact that it can be purchased ready-made and comparatively cheap would be much in its favor. The results, however, were very unsatisfactory, as will be seen below.

We experimented also with distillate oils, both in mechanical mixture with water and in emulsions. A number of these oils and emulsions were furnished us by the Densmore-Stabler Refining Company of Los Angeles for the purpose of experimentation. These were the 28° distillate treated and untreated, and the 33°–35° distillate and emulsions made up from these oils.

Danger to Blossoms.—All this spraying in the orchards was timed as far as possible by the condition of the trees; that is, it was done generally just before they burst into blossom. In very many instances the spraying could not be done until the trees were in full bloom. It has not usually been thought possible to spray when the blossoms were out without seriously injuring or killing them, especially with a spray of this strength.

Spring spraying must be done nearly at blossoming time, and may easily be delayed by various causes until the trees are in blossom; much attention was therefore given to the danger of injury by spraying while the trees were in bloom. The blossoming dates for 1902 of the various varieties of peaches grown in large quantities in the Placer County district are given in the following table. The varieties are arranged in approximately their ripening order:

BLOSSOMING PERIODS OF PEACHES.

Variety.	First Blossoms.	Full Blossoms.
Alexander	March 15	March 20
Hale	March 15	March 20
Triumph	March 16	March 21
Imperial	Feb. 25	March 2
St. John	Feb. 24	March 1
Early Crawford	March 10	March 15
Foster	March 5	March 12
Susquehanna	March 5	March 12
McDevitt	March 2	March 8
Levi	March 13	March 18
Salway	March 15	March 20

The large experiment was with one lot of some two hundred Hale trees at the Newcastle station, which were sprayed with the lime, salt and sulfur compound on March 17th and 18th, just as the trees were nearing the period of full bloom.

This is a variety that exhibits a strong tendency to drop the buds in the spring, yet the trees that were sprayed when in blossom set fruit quite as freely as the unsprayed check trees in the neighborhood, and also as did the trees that were sprayed earlier in the season.

Of course, some blossoms were injured by this treatment, but absolutely no commercial damage was done, and the fruit on these trees was evenly distributed and had to be thinned. The injury to blossoms apparently occurred only when a fully open blossom stood in such a position as to be filled by the spray and to retain this material in the cup. This combination of conditions, however, existed in so few cases that the number of blossoms that were killed by the spray was exceedingly small. A tree will have blossoms in all conditions from the swelling bud to the fully open flower, and if the latter had been all killed it is possible that there might be no real loss.

The effect of the atmospheric conditions was seen very clearly in a portion of this experiment. During a few hours of the time when this work was being done the atmosphere became extremely dry, because of a north wind. The trees sprayed during this time lost a much larger number of blossoms, and tender twigs were also killed. No damage, however, occurred when the usual moist atmospheric conditions of this season of the year prevailed. Our experience this season has indicated that the blossom of this variety of peach is more susceptible to injury by spraying than is the case with any other; and only during the time drying winds are blowing need there be any hesitancy in spraying, even though the tree is in bloom.

The latest spraying in the experimental orchards on Early Crawfords was March 5th and 7th, a few days before the first blossoms appeared, but after the buds were beginning to burst. No trace of injury was observed. Some Fosters were sprayed on March 1st, and others on March 5th and 7th. On the latter date, one of the trees that was nearly in full bloom, having a large number of fully opened flowers on it, was sprayed with especial pains and thoroughness, completely drenching it with the spraying material, in order to produce injury, if possible. A careful watch was kept of this tree, and the actual loss to it, so far as could be made out, was eleven blossoms. The tree in question is fourteen years old, and had many hundreds of blossoms out when the spraying was done. So much fruit set on this tree that heavy thinning-out had to be done late in April, when 1,635 peaches were taken from it, leaving still a good crop on the tree. (See Fig. 6.)

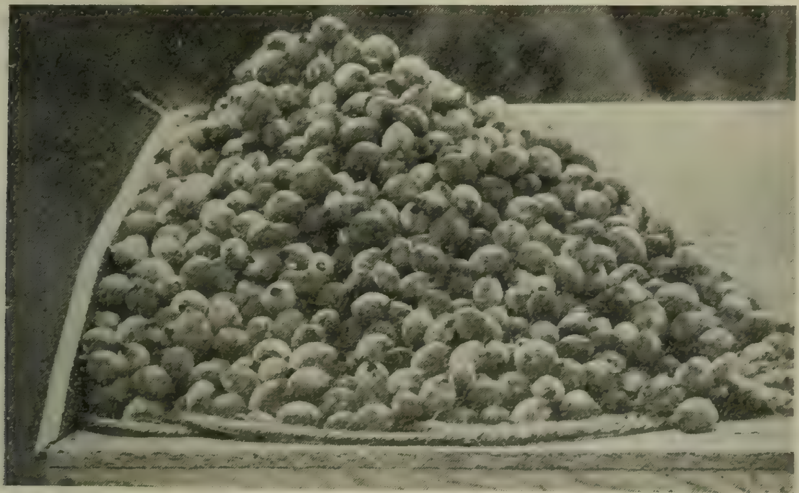

FIG. 6. Fruit from thinning of Foster tree sprayed when in full bloom.

A number of Susquehanna trees were sprayed on March 12th, 13th, and 14th, just when they were in full bloom; no apparent damage was done to the flowers, and the fruit required very heavy thinning.

Spraying was done on a number of the McDevitts on the 11th of March, after some of the blossoms had fallen, and again no damage was done.

These experiments were practically duplicated in many different orchards, and the same results were obtained in each case. It can thus be safely said that late spraying with lime, salt and sulfur, under the conditions obtaining in Placer County, does not in any appreciable way affect the crop, provided the spraying is not done when the atmosphere is extremely dry.

Our work with *oils and emulsions* began on March 31st, when the trees had begun to set fruit and most of the blossoms had fallen. Enough of these remained, however, for us to see the effect of the materials used on the flowers, and some slight loss of fruit through burning of the blossoms was shown. This burning was quite as evident when the emulsions were used as weak as one part of the emulsion to fourteen of water as when the distillate oil was used in the proportion of one of the oil to three of water. Altogether one hundred and sixty-eight Salway peach trees were sprayed with these materials.

We also experimented with the so-called *Hercules emulsion* of 28° distillate oil, spraying fourteen Salway peach trees on March 22d with this preparation, used in the proportion of one to ten of water. At this time the trees were just past full bloom, and the spraying resulted in considerable loss, on account of the blossoms being scorched. Fully one fifth of the blossoms on these trees were destroyed by the spray.

SPRING HISTORY OF THE WORM.

As the spring opened it became possible to follow the beginning of the spring activity as it occurred in the orchard under normal conditions. The worms remained inactive in their burrows until early in March, when they began to work their way out.

Escape from Burrow.—The process of leaving the burrow was observed very continuously during this time in the breeding-cages, where twigs containing hibernating larvæ were placed with their ends in moist sand; on the net-covered tree, where one hundred and thirty-five worms were under observation; and also in the orchard trees, where perfectly natural conditions were found. These three sets of observations gave results that tallied in all particulars. It was found that when the warm-weather conditions had prevailed to a sufficient extent to make the sap begin to flow appreciably in the tree, then the worms also became active and began to work their way out of their winter burrows.

Their first efforts to obtain this end consisted in a tearing away of the silk lining of the burrows. This tearing-away process began with the removal of the floor portion of the lining, and continued until about two thirds of the covering portion had been removed. While doing this the worms first fed on the tender tissues of the bark beneath the original burrow, but after a few days they began to eat their way toward the surface, filling the burrows behind them with excrement. They usually reached the surface in from ten days to two weeks. During this time a considerable increase in size could be seen, and also a marked change in color, the worms becoming of a much darker shade.

Attack on Buds.—The worms when they appeared on the surface were from 3 to 4 millimeters in length. These worms spent the first two or three days after leaving their burrows wandering about on the bark of the tree. They then attacked the young growth and bored their way into the pith of the starting bud, either from the side or at the tip, the latter being the point most generally chosen.

Frequently the worms contented themselves with merely boring into the pith from the side and then withdrawing and attacking some other shoot. The twig so attacked was so weakened at the point where entry was made that the portion above the wound soon died away. One worm might attack many buds in this way and the injury to the tree be multiplied. The worm, again, frequently bored its way into the pith of the chosen shoot and then took a downward course, eating away all of the twig save a mere shell of bark and fibrous material on the outside of its burrow. This burrow was partly filled with excrement, but at no time did we find a burrow sufficiently filled with voided material to interfere with the ready passage of the worm up or down. The worms might attack a number of twigs in this way, and here also the injury that a single worm might do was multiplied. The twig that is attacked very quickly wilts and dies, and this wilted appearance of the twigs is a good indication of the presence of the worm at work in the tree. Indeed, the work done by the worm at this time and the after-appearance of the twig are quite characteristic and easily recognized. In Fig. 7 is given a good illustration of this work of the "bud-worm," as the creature is known in this stage of its life, and the wilted appearance of three or four leaves above the point where the worm is at work can be seen. Fig. 8 shows a section of a newly-started twig, down which a worm had burrowed its way until it had reached the old and hard wood.

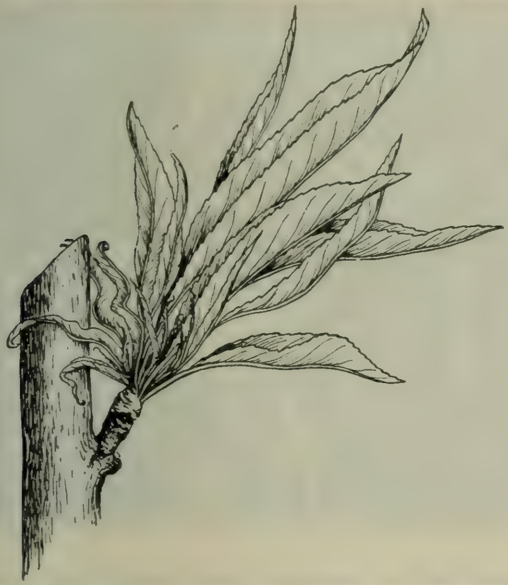

FIG. 7. Wilting following attack of bud-worm.

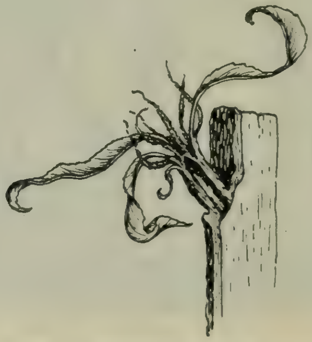

FIG. 8. Section of twig, showing burrow made by bud-worm.

Again, in Fig. 9 can be seen a photograph of, first, a twig which had not been attacked at any time by the "bud-worm," and then of several on which the attack was very severe. It will be seen from these illustrations that the work of the "bud-worm" may result in very serious consequences to the tree as well as to the crop, if not actually threatening the very existence of the tree itself. In many instances of the bud-worm work that came under observation this season, the tree appeared as though burned by fire.

The attack of the bud-worm is generally more to be noticed and feared on young trees than on older ones. We have found that three or four worms could completely destroy a three-year-old tree, and while this attack on an older tree would be serious, yet it would not be fatal.

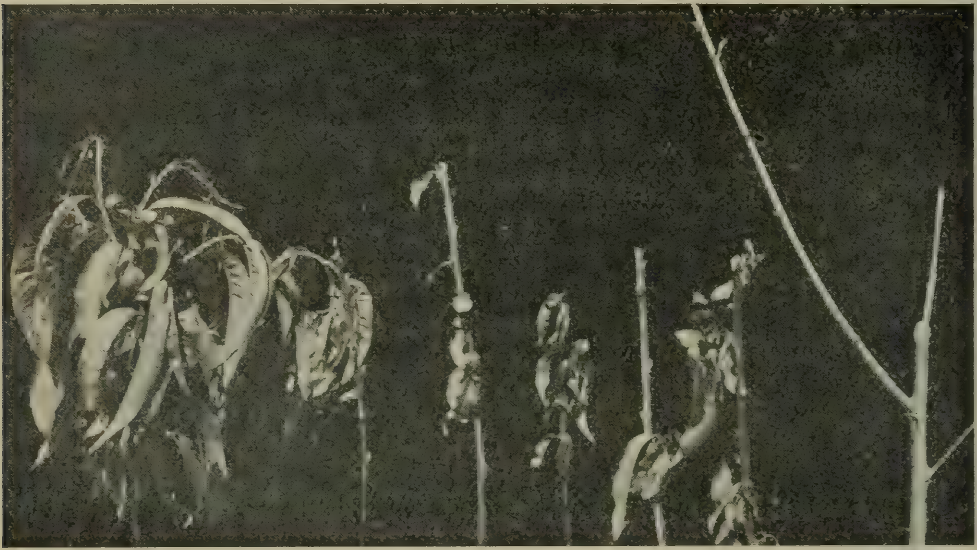

FIG. 9. Results of bud-worm attack, shown in the six twigs on right. Left-hand twig has not been attacked.

The most serious work of this kind is in newly-placed grafts and dormant buds, which are very frequently attacked and destroyed.

The work of the worms in the buds and new twigs continued until pupation was first observed in the latter part of April. The full-grown larvæ at this time were about 10 millimeters in length and the general color quite dark, the characteristics as shown by the young larvæ remaining almost unchanged.

RESULTS ON BUD-WORM OF EARLIER WORK.

Our first comparisons of the effect of the spraying experiments were made possible when the bud-worm work began to be evident, which was in the latter part of March and early in April. At this time it was found that the worms were very plentiful all over the district on such trees as had not been sprayed at all. From one of our check-trees at the Newcastle station we cut out eighteen bud-worms, and the average number on some forty unsprayed trees on this place was eleven worms. The same heavy infestation was shown at the Ophir station also, while from one unsprayed tree at station A we removed twenty-three bud-worms. Check-trees at stations B and C were also badly infested; while the unsprayed orchards generally were infested at the rate of from two to ten worms to the tree. The number of bud-worms found on the check-trees through the whole district indicated that the season was a favorable one for the peach-worm.

On sprayed trees, using the same bud-worm basis of computation, we found that where the IXL compound had been used no control of the worm whatever had been obtained. The trees on places 2, 3, 4, 5, and 6 were as badly infested with the bud-worm as though no spray at all had been used, and from five to twelve worms were cut from many of the trees on these places. Some of the trees, and this especially on place No. 6, appeared as though burned, as the result of the work of the bud-worm. No "curl-leaf" was noted among these trees, and their general condition, other than the effect of the bud-worms, was fair.

The trees which had been sprayed with the distillate oils and emulsions showed a very much lighter attack of the bud-worms, for among these trees it was found that the average number of bud-worms was from one to two to the tree; while from the check-trees, unsprayed, on the same orchard, we cut from eight to twelve bud-worms. These oil-sprayed trees were affected with "curl-leaf" quite severely.

The lime-salt-and-sulfur-sprayed trees, when the spraying had been done in the early spring, showed the most satisfactory results of any at this time. On the various station orchards, comprising over 12,000 peach trees, the average number of bud-worms was about one to every ten trees, and this average was maintained on many other orchards in the district. Indeed, it was a difficult matter to find the worms in these orchards, and it was only by the closest scrutiny of the trees that they could be located in them. The general condition of these trees was excellent and a marked absence of "curl-leaf" was noted.

An examination of the trees in orchard No. 1, that had been sprayed with the lime, salt and sulfur early in February, showed that the attack by bud-worms was severe. On many of the trees from which we cut the worms we found from five to nine to the tree. The general condition of the trees was good and a very small amount of "curl-leaf" was present.

Winter spraying with the Hercules distillate emulsion in February at the Ophir station also resulted in leaving the bud-worms in dangerous numbers. The trees of the kerosene emulsion and the kerosene oil and water experiments at the Newcastle station, which had been winter-sprayed, showed also heavy infestation. Indeed, the condition of these trees was so bad that, fearing the moths might spread from them to the balance of the orchard, all the bud-worms were cut from the twigs.

The following table gives this work and its result in detail:

TABLE SHOWING BUD-WORMS ON WINTER-SPRAYED AND UNSPRAYED TREES.

Variety.	Spray Used in Winter.	Bud-Worms Removed from Sprayed Trees.	Bud-Worms on Unsprayed Check-Trees.
Hale	Kerosene emulsion 1 part, water 8 parts	19	20
Hale	Kerosene emulsion 1 part, water 10 parts	21	20
Hale	Kerosene 1 part, water 3 parts	18	20
Salway	Kerosene emulsion 1 part, water 8 parts	17	16
Salway	Kerosene emulsion 1 part, water 10 parts	19	16
Salway	Kerosene 1 part, water 3 parts	22	16

The Pupa.—The pupa or chrysalis of the peach-moth, shown in Fig. 10, varies from light to dark yellow in color. It is from 5 to 7 millimeters long, and is rather broad in comparison with its length. The segments of the abdomen are well defined, but only the last three are movable, allowing a certain small amount of movement of a twitching nature. The eye spots are of a darker color than the rest of the pupa, and are quite prominent.

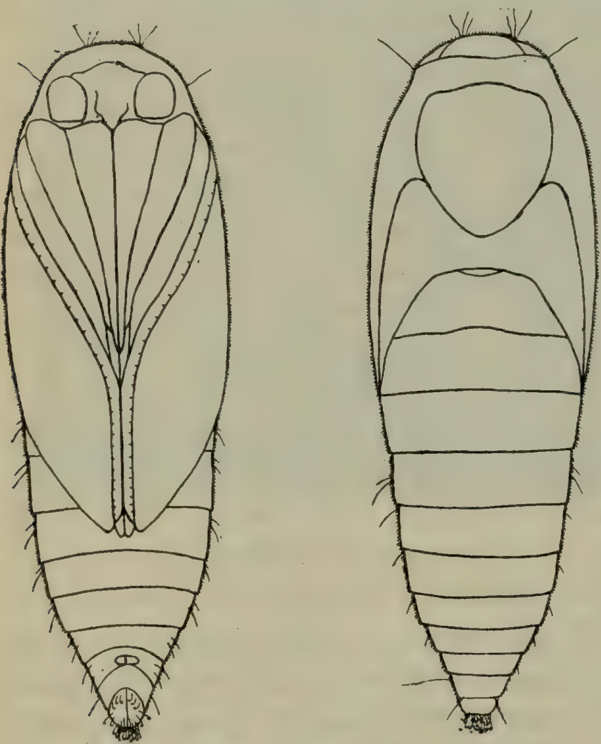

FIG. 10. The pupa. Dorsal and ventral views.

Pupation.— The worms having attained their full growth, withdrew from the green material in which they had been working and crawled down the limbs to the main branches and to the trunk. Here the rough bark offered many places of scanty concealment sufficient for pupation. The worm, in at least the greatest number of cases, chose for this purpose the hollow formed by the curling-up of small portions of the outer bark. These "curls" of the bark are quite characteristic of the peach tree and are constantly present on the trunk and larger branches. The worms, after crawling into these curls, weave an extremely loose cocoon—a few threads of whitish silk drawn irregularly across the open portion of the curl, and a slight silken carpet, to which the hooks at the end of the abdomen of the pupa are attached, constituting the whole structure. As far as our observations go this is always the method of cocoon-making. This cocoon merely serves to hold the pupa in place, and does not in any other way serve to protect it. In ninety-two per cent of the cases noted the position was well down on the trunk of the tree. In a very few cases the worms pupated in the "curls" of the bark quite well up in the tree, and in only three per cent of the cases noted did pupation take place under broken places in the bark where there is no evident curl. After choosing their pupation places and spinning their slight, web-like cocoons, the worms proceeded to pass into the pupa form, attaining it in from two to two and a half days. Fig. 11 shows the pupation place and the cocoon.

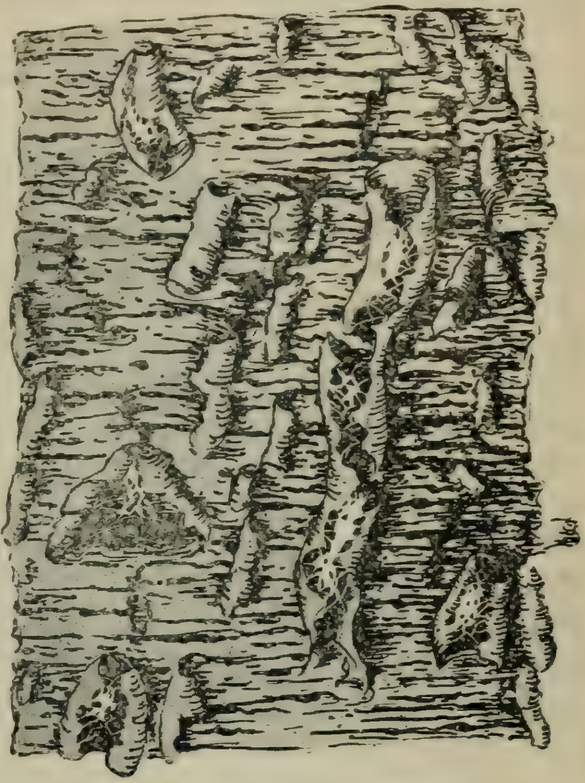

FIG. 11. Pupation place and cocoon.

CAMPAIGN AGAINST THE PUPA.

Two points in this matter of pupation seem of economic importance, and were made the basis of some of our experiments for the control of the worm. Unlike the codling-moth larva, peach-worms crawl down the tree to the trunk, and do not drop to the ground and then crawl to the tree. Secondly, the large majority of the worms pupate on the main trunk of the tree.

These experiments consisted of the use of band traps, and of oil spray on the trunk.

Band Traps.—Since the use of bands as an adjunct to spraying operations in certain cases against the codling-moth is generally recognized as effective, it was thought by ourselves and by some growers that these devices might be of more or less value in the case of this insect, and that it was important to test what value they might have. To determine this point, the following experiments were made: On April 15th, pieces of "sticky fly paper" were placed on the ground close about the trunk of a peach tree, in such a way that a worm coming to the tree would have to cross the paper to get on the trunk. Eleven days later there were seven pupæ taken from the trunk of this tree and not a worm had been taken on the paper. On April 16th paper was placed in the same way about another tree, and fourteen days later twelve pupæ were taken from the trunk of this tree, but not one worm was on the paper. On the 4th of April bands of burlap were put about the trunks and larger limbs of five trees. These trees and the bands were carefully examined from time to time, and four of these trees yielded seven pupæ apiece, yet not one of these was found beneath a band. They were all placed within the "curls" of the bark, as described above, and on the main trunk of the tree. Some were above and some below the band on the trunk. On the fifth tree one pupa out of eight was beneath the trunk band, but in a "curl" of the bark. Paper bands were used, with the same result as when the burlap was used. "Sticky paper" was used as a band in one case in this generation. This paper was placed about the trunk just where the branches began, and on this paper two worms were taken. Seven pupæ were taken in a space of six inches above this band and none below it.

Furthermore, we have observed in four different instances the full process of pupation in this generation, and in every instance the worm crawled down the tree from the green twigs (where it had been eating) to the main trunk, entered one of the "curls" of the bark, and there went through the process. In no case observed did the worm drop to the ground and then make its way to and up the trunk of the tree, and from our observations and from the results obtained from our "sticky paper" and band experiments, we should consider that such a proceeding seldom or never occurs. We could find no warrant for the use of band traps in the campaign against the peach-worm.

Oil Spraying.—Early in May the conditions existing on place No. 2, which is noted as having been sprayed with the I X L compound, were very bad. The attack of the bud-worm was severe on this orchard, and at the time noted these worms had begun to pupate. The pupæ seemed to be quite accessible to sprays in their slight cocoons on the trunk and larger branches, and we determined, with the assistance of the owner, to see what effect spraying with kerosene-oil and distillate-oil emulsions would have on these pupæ. On May 15th and 16th, after a few moths had emerged, but while most were still in the pupa form, we sprayed these trees. The emulsions were made up of the 28° and 33° distillate and with 150° kerosene oil. These emulsions were diluted with water in the proportion of one to eight, and this material was thoroughly sprayed over the trunks and larger branches of the trees. Care was taken not to spray the material on the leaves and new growth, yet some of it did lodge in such positions. Where this occurred the leaves and twigs were badly discolored (yellowed), but in a few weeks they regained their normal color and health. This discoloration occurred quite as much in the case of the kerosene emulsion as in that of the distillate-oil emulsion. Two days after this spraying was done we removed a number of the pupæ from the trees and kept them under observation for four weeks. Moths emerged from two of the twenty pupæ so kept, the rest having been killed by the spray. The ultimate results of this treatment, as shown by the percentage of wormy fruit, will be seen in the discussion of that subject below.

THE MOTH.

The adult moths began to emerge from the pupæ in from ten to twelve days. They are of small size, very delicate, with narrow, well-fringed wings. The color is quite subdued, being a beautiful dark steel-gray in general effect. On closer examination it will be noticed that this general color is relieved by certain darker spots on the fore wings, which are folded over the abdomen when the insect is at rest. The palpi are quite prominent and are usually bent back over the insect's head, having the appearance of horns. The antennæ are very delicate, of a grayish color, ringed with brown, and are laid on the wings when the moth is at rest. The hind wings are much lighter in color and more heavily fringed than the fore wings, and both pairs of wings seem under the magnifying glass to be dusted over with a grayish powder. The length of the moth when at rest is about 7 m.m., and with wings expanded the insect measures 14 m.m. from tip to tip. It differs from other members of the group in certain minute particulars not easy to specify. These other moths are not likely to be found in the same situations, so that the above description will enable one to be fairly certain of their identity.

The moths are very quick in their movements and are easily disturbed, flying rapidly from one place of concealment to another in the orchard.

Lantern Traps.—The value of lantern traps in the war against the related potato-worm, reported in Bulletin No. 135 of this Station, suggested their use in this case also. The traps were therefore thoroughly tested during May, when the moths were on the wing. A number of lantern traps made after the Colorado type* were used. These traps consist of a piece of bright tin made into a funnel shape and opening into a wooden bottle. In this bottle is placed a piece of cyanide of potassium wrapped in paper. Over this a little excelsior (wood shavings packing) is placed. When in use the trap is hung to some tree in the orchard, a lantern is hung just above it, and the poison bottle is slipped over the bottom opening of the funnel. Insects attracted by the light readily find their way into the funnel and then into the poison bottle. Beetles taken thus crawl into the loose packing in the bottle and do not injure the more delicate insects which may be taken and which remain on top. Many specimens of various genera of beetles were taken, and some moths, a few parasitic hymenoptera, and many mosquitoes (*Culex* and *Anopheles* sp.) were victims of these traps, but we looked in vain for the peach-moth. Not a single peach-moth was taken by these traps during the experiment, in spite of the fact that they were present in numbers in the orchards.

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* Bulletin 43, Colorado Experiment Station.

EGG-LAYING.

The moths began egg laying on May 9th. The newly-placed egg is pearly white, and shows under the microscope a rather coarse reticulation. Before hatching the color changes to a deep yellow, almost orange color, and at this stage the egg is quite conspicuous. It is about two fifths of a millimeter in length by one fifth in breadth, being a rather long oval in shape, about twice as long as broad.

These eggs were generally placed in the new twigs near the bases of the leaves, and from one half to two thirds of the distance out from the point of beginning of the twigs. The eggs were placed lengthwise of the twigs, and in a few cases were concealed beneath the bracts at the bases of the leaves. We could, however, note no general attempt at concealment of the eggs under these bracts or spurs, as is recorded by Marlatt (Bulletin 10, n. s., U. S. Dept. of Agric., Div. of Entomology, p. 13), and they were as a rule plainly to be seen. The illustration (Fig. 12) shows the general distribution of the eggs in the neighborhood of leaf bases, some eggs being laid singly and some in loose clusters. They are rather insecurely glued to the surface of the twig.

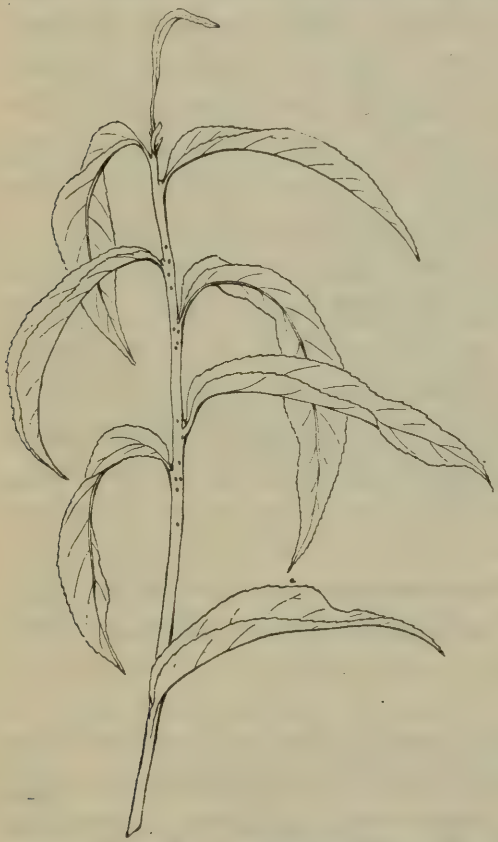


FIG 12. Eggs of Peach-moth in position on twig.

WORMS OF THE SECOND GENERATION.

Young worms began to come from these eggs on as early as May 19th, the period of incubation being about ten days. The newly-hatched larvæ were about three fourths of a millimeter in length, and did not differ in general appearance from the hibernating worms as described on a previous page.

These worms were restless for the first two or three days of their lives, wandering about on the twigs and apparently doing scarcely any eating.

Finally they would select a place a short distance from the tip of the twig and eat into it at the base of a leaf, bore into the pith, and then follow down the pith in the same manner as the first generation of worms did. This boring process was not observed in any case to extend down the twig more than an inch, and the same worm would attack many twigs. Frequently, also, as in the first generation, the worm would merely bite into the twig a short distance and then withdraw, not having reached the pith. In either case, however, the apparent damage was the same, as the twig died above the point of attack, and some bud below the injury would have to be forced out to take the place of the terminal bud, in order to continue the growth of the twig. This dying-back being entirely at the ends of the twigs, and the leaves soon drying to a pale yellow, rendered this injury quite evident. (See Fig. 7.)

The worms act thus as "twig-borers" for a period covering about twenty days, and then seek the fruit, if any is on the tree. If there is no fruit on the tree, then the whole life of the worm will be spent as a "twig-borer," and the damage of this kind becomes all the more evident.

Attempt to Poison these Worms.—Reports of success by the use of Paris green against the bud-worm indicated a possible means of control. The experimental work was done when the worms of the second generation had begun to appear, which was about May 19th, and the poison used was from samples furnished by the Station laboratory at Berkeley. These samples are designated as Nos. 610 and 611, and the following tables give the method of work and results obtained from their use. The mixtures in all cases were made up with lime in the proportion of 5 pounds to 100 gallons of water. The lime was first slaked and a milk of lime made, and this mixture was strained to remove lumps and grit. The desired amount of Paris green was then made into a paste with water, and added to the lime water in the proportion being experimented with. The atmospheric moisture was determined by a device consisting of a string six feet long, hung in such a way that, while the air had full play upon it, it was in the shade at all times and no wind blew upon it. A light weight was hung to the end of this string. The string would shrink up when the atmosphere was humid, and regain its normal length under dry conditions. This method gave us the comparative humidity only, but this was enough for the purpose.

Table of Experiments with Paris Green, Sample No. 610.

Proportions Used.	When Applied.	Atmospheric Humidity.	Condition of Leaves.	Injury to Leaves.	Injury to Fruit.
1–800	May 20, 7 A. M.	High	Turgid	Slight	No fruit
“	May 20, 11 A. M.	Medium	Turgid	Some	No fruit
“	May 20, 2 P. M.	Low	Wilted	Much	No fruit
“	May 20, 6 P. M.	Low	Wilted	Much	No fruit
“	May 27, 7 A. M.	Mod’t’ly high	Turgid	Some	In spots
“	May 27, 11 A. M.	Below medium	Sl’tly wilted	Some	In spots
“	May 27, 2 P. M.	Low	Wilted	Much	In spots
“	May 27, 6 P. M.	Very low	Much wilted	Much	In spots
1–1600	May 22, 7 A. M.	High	Turgid	Some	Some
“	May 22, 11 A. M.	Medium	Turgid	Some	Some
“	May 22, 2 P. M.	Low	Wilted	Much	Some
“	May 22, 6 P. M.	Very low	Much wilted	Much	Some
“	May 29, 7 A. M.	Mod’t’ly high	Turgid	Slight	In spots
“	May 29, 11 A. M.	Below medium	Sl’tly wilted	Some	In spots
“	May 29, 2 P. M.	Low	Wilted	Some	In spots
“	May 29, 6 P. M.	Very low	Much wilted	Much	In spots

Table of Experiments with Paris Green, Sample No. 611.

1–800	May 21, 7 A. M.	Very high	Turgid	None	Slight
“	May 21, 11 A. M.	Medium	Turgid	Some	Slight
“	May 21, 2 P. M.	Low	Wilted	Much	Much
“	May 21, 6 P. M.	Low	Wilted	Much	Much
“	May 28, 7 A. M.	High	Turgid	Some	Some
“	May 28, 11 A. M.	Medium	Turgid	Some	Some
“	May 28, 2 P. M.	Low	Wilted	Much	Much
“	May 28, 6 P. M.	Low	Wilted	Much	Much
1–1600	May 21, 7 A. M.	Very high	Turgid	Some	In spots
“	May 21, 11 A. M.	Medium	Turgid	Some	In spots
“	May 21, 2 P. M.	Low	Wilted	Much	Much
“	May 21, 6 P. M.	Low	Wilted	Much	Much
“	May 28, 7 A. M.	High	Turgid	Very little	Some
“	May 28, 11 A. M.	Medium	Turgid	Some	Some
“	May 28, 2 P. M.	Low	Wilted	Much	Much
“	May 28, 6 P. M.	Low	Wilted	Much	Much

It will be seen that, so far as the apparent injury goes, there was no material difference between the samples used, which were both greens that had passed the California test and were good. In every instance, save one, the material burned the foliage. It will be seen from the table that in the 7 A. M. experiment of, May 21st, with sample No. 611, no damage was apparent, so far as the foliage is concerned, and only a slight burning of the fruit. Whatever the reason for this exception, the fact remains that, under the conditions most commonly obtained, there was more or less damage done to both leaves and fruit in all the other experiments. The damage consisted in the entire destruction of the leaves in some cases, in the destruction of the pendent portion of the leaves where a drop of the material gathered in other cases, and in spots being burned in the leaves in still others. The fruit injury consisted generally in the burning-out of spots upon it; and these spots did not develop, but either gave the fruit an unsightly appearance, or decay started in the injured place and the fruit rotted.

The experiments as tabulated were paralleled by another series, in which a spray of water was used before the Paris green mixture was applied, and the tree well moistened. The results in nowise differed from those reported above in detail, which were sprayed in the usual manner. These results were furthermore confirmed on another place near the Newcastle station, where spraying was being done on some pear trees with Bordeaux mixture to which Paris green had been added in the proportion of one pound of the Paris green to 180 gallons of the latter. Two peach trees, four years old and in full foliage, were, by error of the workmen, sprayed with this material. The result was that the leaves and many of the young branches were killed outright.

The experiments with the Paris green were carried no further, as the damage done to the trees and fruit was so great as to render it certain that its use would be wholly inadvisable under the conditions existing in Placer County.

STUDY OF THE FRUIT-WORM.

Early in June the second generation of worms begins operation as fruit-worms. They had been working some time as twig-borers as already described, but for some unknown reason now began to leave the twigs and attack the fruit.

It is in this work in the fruit that the insect does its greatest damage and has attracted most attention. The attack on the fruit is very characteristic, nothing else being mistakable for it.

The worms of the second generation on leaving the twigs bore into the peaches at the stem end in a majority of cases. Not only is the stem end thus generally chosen for the beginning of the attack, but a certain portion of the stem end—the line that is called the suture. After boring through the skin the worm begins to feed upon the tissue of the fruit beneath, often excavating a large chamber, which is more or less filled with gummy matter and excrement. The mouth of the burrow is also generally filled with these materials mixed together.

The skin above the hollowed-out portion of the fruit first turns dark and shrivels up to a certain extent, and finally decay usually sets in. When riper fruit is attacked the worm frequently burrows to and around the pit; and if the latter is split it often attacks the seed.

The worm may, under certain circumstances, make its attack at other points than in the stem end of the fruit. Quite frequently when two peaches are in contact on the tree, the worm bores its way into one of the fruits at this point of contact; or if a leaf or twig touches the fruit, here also the worm may enter. The character of the injury is the same in any of these cases, and the fruit is ruined.

PUPATION.

Early in July the most precocious worms of this generation begin to withdraw from the fruit and to pupate, and this coming-out for pupation continues as late as the last of August before the last of them have completed their work. The position chosen for pupation is in the stem end of the fruit, and usually not the one in which the worm has been working, but often a sound, uninjured one.

The worm lays itself along the suture-hollow in the stem end of the peach, and fastens itself here by two strands of silk, making less attempt at a cocoon than in the first generation. In from twenty-four to forty-eight hours it passes into the pupa form. Though this is the usual place and method of pupation in this generation, there are a number of other modes. In some instances the worms choose a space between two peaches that lie close together, finding here a satisfactory place of concealment. In a few cases this change took place in rough places on the bark, or under leaves lying against small branches or twigs. In Fig. 13 will be seen pupæ in the positions chosen by the large majority of the worms as described above.

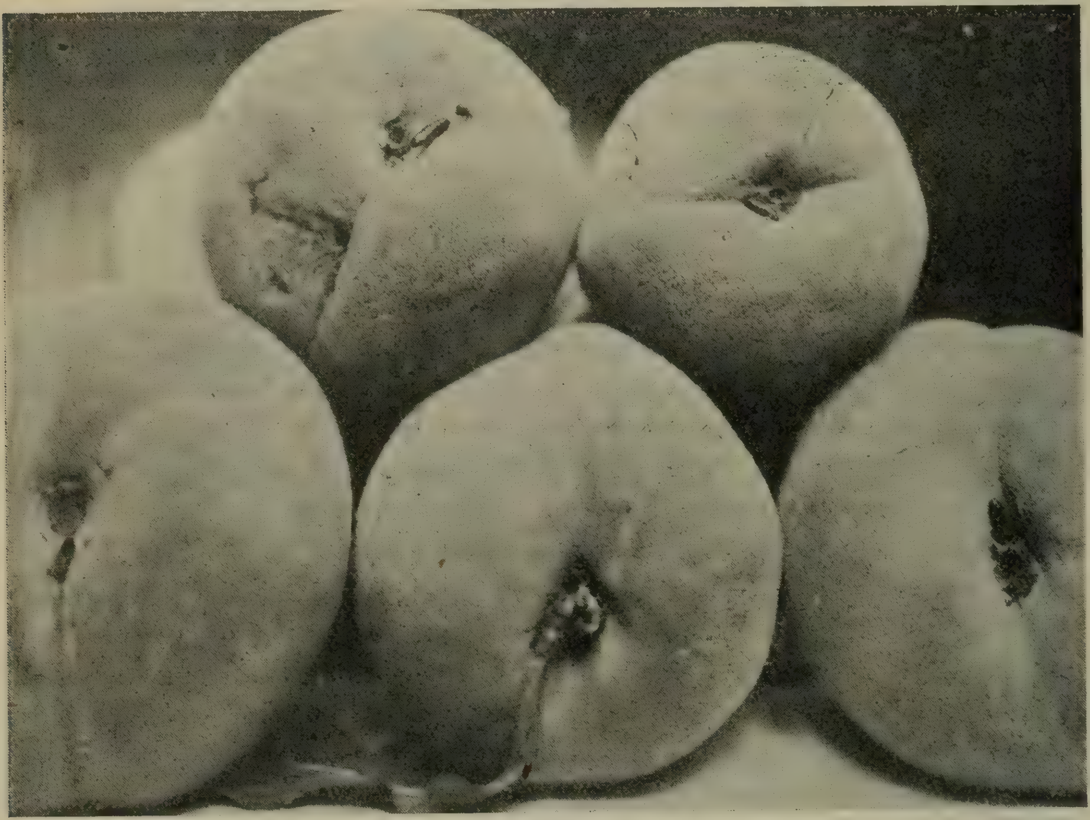


FIG. 13. Pupæ of the second generation of peach-worms in position upon the fruit.

These pupæ do not differ in any way from those produced by the first or winter generation of worms.

THE MOTH AND EGG-LAYING.

The moths issue from these pupæ in seven days, and do not differ appreciably from those of the spring generation. Egg-laying began on the second or third day after emergence, and usually continued for three days. These eggs, which are shown much magnified in Fig. 14, are placed on the edge of the depression where the stem is attached to the fruit; and were not, in any instance noted, placed on the twigs, as are the eggs from the moths of the other generations. The eggs are usually placed singly, and no real grouping of them was seen, though in some cases two or three were found quite close together. The fuzziness so characteristic of the peach seems to render a secure fastening of these eggs impossible, and they could be easily removed from their position.

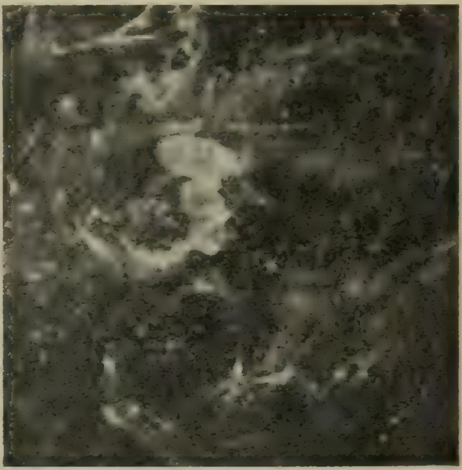


FIG. 14. Eggs of the second generation peach-moth in position on fruit; much magnified.

WORMS OF THE THIRD GENERATION.

The young worms began to appear on the sixth day. They first wandered about on the surface of the peaches for a few hours, and then ate their way into them in much the same manner as the worms of the second generation. The worms of this brood are the only ones that enter the fruit immediately on hatching. They make, therefore, at first very minute burrows, contrasting strongly with freshly-made burrows of the preceding generation.

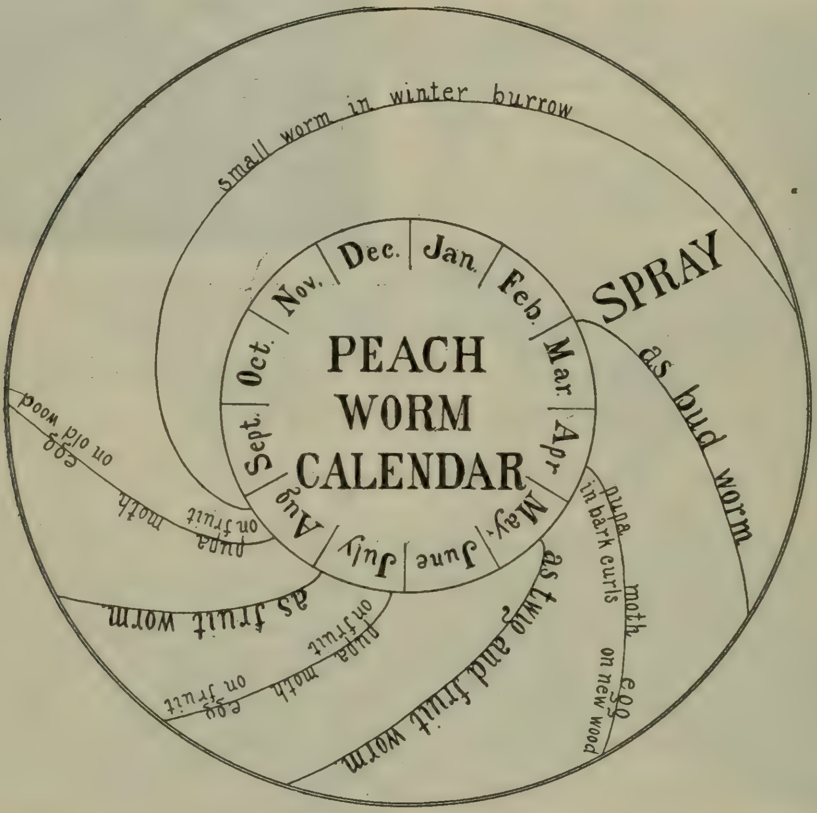
FALL HISTORY OF THE INSECT.

The worms of this generation continue their work in the fruit for about a month, when, their full growth having been reached, they come to the surface to pupate. The method of pupation and position chosen for this purpose differ in nowise from those of the second generation, as described above. About six days were spent in the pupa form, and the moths began to appear about the middle of August.

Egg-laying began in the latter part of August and continued well into September. These eggs were placed sometimes in small cracks and crannies of the bark, and sometimes quite exposed on the bark of the older wood just above the crotches formed by the new wood.

The eggs hatch in about five days, and the young worms, which are from one half to three fourths of a millimeter in length, immediately proceed to bore into the bark of the crotches formed by the new wood with the growth of the previous year, and to prepare their winter quarters. In the region under investigation hibernation was well begun this season on September 1st, and the fully-made chambers, as previously described, could be found readily and in numbers. If the conditions as noted this season are normal, then the worms live in their winter quarters during all of the fall and winter months, remaining quiescent for fully half of the year.

The life history as worked out in this investigation is graphically shown in the accompanying calendar.



RESULTS FROM SPRAYING EXPERIMENTS.

As the summer advanced the work of the worms in the fruit became more and more apparent, until, as the various kinds were picked, we were able to determine the final results obtained through the use of various spray materials. The following table is compiled from the detailed record of the experiments on the five station orchards, and from work done on twelve other selected places on which we took complete records. Only two not-sprayed places are directly referred to, but the heavy loss found on these places is practically the same as found on other places where there was the same neglect of spraying. The percentages of loss were obtained in nearly all cases from actual weights of wormy fruit, though in a few instances the figures represent an actual count of the peaches.

ALEXANDER. Time of first blossoms, March 15.

Designation of Orchard.	Spray Material.	No. Trees.	Time of Spraying.	Per Cent of Loss.
Ophir	Lime, salt and sulfur	50	April 1	1
Ophir	Check trees	4	Not sprayed	50
A	Lime, salt and sulfur	150	March 12	1
A	Check tree	1	Not sprayed	35
B	Lime, salt and sulfur	50	March 10	1
C	Lime, salt and sulfur	275	March 10	3
7	Lime, salt and sulfur	50*	March 8	1
8	Lime, salt and sulfur	100*	March 8	1
9	Lime, salt and sulfur	220*	March 6	2
10	Lime, salt and sulfur	300*	March 10	15
1	Lime, salt and sulfur	110*	Feb. 1 to 6	20
2	I X L compound	300*	March 8	--
2, resprayed	28° dist. emul., 1 to 8 parts water	100*	May 15	6
2, resprayed	33° dist. emul., 1 to 8 parts water	100*	May 15	6
2, resprayed	150° kero. emul., 1 to 8 parts water	100*	May 15	8
3	I X L compound	300*	Mar. 7, Apr. 6	40
3	Check trees	5	Not sprayed	40
4	I X L compound	350*	Mar. 8, Apr. 9	50
5	I X L compound	450*	Mar. 10, Apr. 10	65
6	I X L compound	500*	Mar. 8, Apr. 7	60
11	No spray	400*		60
12	No spray	350*		55

HALE. Time of first blossoms, March 15.

Designation of Orchard.	Spray Material.	No. Trees.	Time of Spraying.	Per Cent of Loss.
Newcastle	Lime, salt and sulfur	500	March 17, 18	0
Newcastle	Check trees	5	Not sprayed	55
Ophir	Lime, salt and sulfur	200	March 31	0
Ophir	Check tree	1	Not sprayed	40
A	Lime, salt and sulfur	900	March 13, 14	1
B	Lime, salt and sulfur	300	March 10	1
C	Lime, salt and sulfur	550	March 8, 10	20
7	Lime, salt and sulfur	125*	March 8	1
8	Lime, salt and sulfur	150*	March 12	2
9	Lime, salt and sulfur	600*	March 4, 5	14
10	Lime, salt and sulfur	550*	March 12, 13	15
1	Lime, salt and sulfur	220	Feb. 1 to 6	25
2	I X L compound	250*	March 8	--
2, resprayed	28° dist. emul., 1 to 8 parts water	85*	May 15	20
2, resprayed	33° dist. emul., 1 to 8 parts water	85*	May 15	20
2, resprayed	150° kero. emul., 1 to 8 parts water	80*	May 15	25
3	I X L compound	150*	Mar. 6, Apr. 3	45
3	Check trees	5	Not sprayed	40
4	I X L compound	500*	Mar. 7, Apr. 5	65
5	I X L compound	900*	Mar. 7, Apr. 2	70
6	I X L compound	600*	Mar. 3, Apr. 4	60
11	Unsprayed	650*		65
12	Unsprayed	800*		55

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*Approximate.

EARLY CRAWFORD. Time of first blossoms, March 10.

Designation of Orchard.	Spray Material.	No. Trees.	Time of Spraying.	Per Cent of Loss.
Newcastle	Lime, salt and sulfur	1,000	March 5, 7	0
Ophir	Lime, salt and sulfur	200	April 1	2
A	Lime, salt and sulfur	200	March 8	1
7	Lime, salt and sulfur	110*	March 7	1
8	Lime, salt and sulfur	300*	March 6, 7	2
9	Lime, salt and sulfur	125*	March 3	12
10	Lime, salt and sulfur	350*	March 3	15
1	Lime, salt and sulfur	300*	Feb. 1 to 6	18
5	I X L compound	400*	March 3	45
11	No spray	450		45
12	No spray	400*		40
2	I X L compound	130*	March 8	--
2, resprayed	28° dist. emul., 1 to 8 parts water	65*	May 15	25
2, resprayed	33° dist. emul., 1 to 8 parts water	65*	May 15	25

SUSQUEHANNA. Time of first blossoms, March 5.

Newcastle	Lime, salt and sulfur	400	March 12	1
Ophir	Lime, salt and sulfur	200	April 1	1
A	Lime, salt and sulfur	150	March 3	3
8	Lime, salt and sulfur	200*	March 3	1
9	Lime, salt and sulfur	250*	March 1, 3	5
10	Lime, salt and sulfur	125*	March 1, 3	15
1	Lime, salt and sulfur	200*	Feb. 1 to 6	25
5	I X L compound	250*	Mar. 4, Apr. 3	30
B	Check trees	2	Not sprayed	50

ST. JOHN. Time of first blossoms, February 24.
IMPERIAL. Time of first blossoms, February 25.

A	Lime, salt and sulfur	900	Feb. 21	0
8	Lime, salt and sulfur	500	Feb. 20	2

FOSTER. Time of first blossoms, March 5.

Newcastle	Lime, salt and sulfur	450	March 1	1
A	Lime, salt and sulfur	350	March 3	3
8	Lime, salt and sulfur	400*	March 3	2
9	Lime, salt and sulfur	350*	Feb. 28	6
10	Lime, salt and sulfur	400*	March 2	9
2, resprayed	I X L compound	200	March 8	--
2, resprayed	28° distillate emulsion	100	May 16	20
2, resprayed	28° distillate emulsion	100	May 16	20

McDEVITT. Time of first blossoms, March 2.

Newcastle	Lime, salt and sulfur	330	March 4	1
Ophir	Lime, salt and sulfur	250	April 2	1
A	Lime, salt and sulfur	400	Feb. 24	2
C	Lime, salt and sulfur	250*	Feb. 27	18
7	Lime, salt and sulfur	150*	Feb. 24	4
8	Lime, salt and sulfur	250*	Feb. 24	5
9	Lime, salt and sulfur	300*	Feb. 23	8
10	Lime, salt and sulfur	300*	Feb. 25	7
1	Lime, salt and sulfur	150*	Feb. 1 to 6	25
11	Not sprayed	400*		50

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* Approximate.

LEVI. Time of first blossoms, March 13.

Designation of Orchard.	Spray Material.	No. Trees.	Time of Spraying.	Per Cent of Loss.
Newcastle	Lime, salt and sulfur	650	March 13, 14	0
Ophir	Lime, salt and sulfur	800	April 2, 3	2†
Ophir	Check trees	3	Not sprayed	25
A	Lime, salt and sulfur	200	March 8	2†
B	Lime, salt and sulfur	500	March 8, 10	1†
C	Lime, salt and sulfur	600	March 6, 7	4†
8	Lime, salt and sulfur	300*	March 9	3
9	Lime, salt and sulfur	350*	March 8	4
10	Lime, salt and sulfur	400	March 12	12
1	Lime, salt and sulfur	330	Feb. 1 to 6	25
2	I X L compound	350*	March 7	--
2, resprayed	28° dist. emul., 1 to 8 parts water	125*	May 15	10
2, resprayed	33° dist. emul., 1 to 8 parts water	115*	May 15	10
2, resprayed	150° kero. emul., 1 to 8 parts water	110*	May 15	12
3	I X L compound	250*	Mar. 8, Apr. 2	40
4	I X L compound	200*	Mar. 6, Apr. 4	20
5	I X L compound	350	Mar. 6, Apr. 5	35
6	I X L compound	450	Mar. 7, Apr. 6	40
11	No spray	600*		45
12	Lime, salt and sulfur	450	Mar. 10, 11	4

SALWAY. Time of first blossoms, March 15.

Newcastle	Lime, salt and sulfur	500	March 12	1
Newcastle	Check trees	4	Not sprayed	50
Ophir	Lime, salt and sulfur	500	April 4	0
Ophir	Check trees	3	Not sprayed	25
A	Lime, salt and sulfur	400	March 7	2
B	Lime, salt and sulfur	500	March 7	1
C	Lime, salt and sulfur	700	March 5	5
7	Lime, salt and sulfur	300*	March 8	1
8	Lime, salt and sulfur	550*	March 8, 10	2
9	Lime, salt and sulfur	450*	March 4	2
10	Lime, salt and sulfur	450	March 7	5
1	Lime, salt and sulfur	350	Feb. 1 to 6	25
Ophir	Distillate emulsion‡	48	Feb. 12	50
Ophir	Distillate emulsion§	168	March 31	45
2	I X L compound	560*	March 7, 8	--
2, resprayed	28° dist. emul., 1 to 8 parts water	190*	May 15, 16	18
2, resprayed	33° dist. emul., 1 to 8 parts water	185*	May 15, 16	18
2, resprayed	150° kero. emul., 1 to 8 parts water	185*	May 15, 16	18
3	I X L compound	150*	Mar. 6, Apr. 4	30
4	I X L compound	350*	Mar. 6, Apr. 5	25
5	I X L compound	500*	Mar. 7, Apr. 7	25
6	I X L compound	450*	Mar. 7, Apr. 9	40
11	No spray	300*		45
12	Lime, salt and sulfur	500		4

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*Approximate. †Estimate.

‡ Hercules distillate emulsion 1 to 8, 1 to 10, and 1 to 12 parts of water, sixteen trees each.

§ Densmore-Stabler untreated 28° emulsion, treated 28° emulsion, and 33° emulsion, 1 to 10 and 1 to 14 parts of water, also treated distillate oil 28°, untreated 28° oil, and 33° distillate, 1 to 3 and 1 to 4 parts of water—fourteen trees each.

UNSPRAYED TREES.

The results obtained in the control of the peach-worm are well shown in these tables. It will be most evident that the season of 1902 was one in which the worms were very plentiful. The check-trees in every case were heavily infested, while the average loss among unsprayed trees indicates the presence of the worms in disastrously large numbers.

Bringing together the unsprayed trees into one table, we see this fact very evident.

PERCENTAGE OF LOSS ON UNSPRAYED TREES.

Variety.	No. of Trees.	Maximum per cent.	Minimum per cent.	Average per cent.
Alexander	760	60	35	48
Hale	1,461	65	40	49
Early Crawford	850	45	40	42
Susquehanna	2	50	50	50
McDevitt	400	50	45	47
Levi	603	50	25	45
Salway	307	50	25	45
Total	4,884	65	25	48

SPRAYED TREES.

The Failure of the I X L Compound.—The same fact is further emphasized in the case of the use of the I X L compound, which proved to be an utter failure as a means of controlling the peach-worm.

PERCENTAGE OF LOSS ON TREES SPRAYED WITH I X L COMPOUND.

Variety.	No. of Trees.	Maximum per cent.	Minimum per cent.	Average per cent.
Alexander	1,600	65	40	53
Hale	2,150	70	45	60
Early Crawford	400	45	45	45
Susquehanna	250	30	30	30
Levi	1,250	40	20	35
Salway	1,450	40	25	37
Total	7,100	70	20	50

These results are very conclusive, both because of the large number of trees concerned, and because the timing of the application was the same as that which gave the best results with the lime, salt and sulfur.

The Use of Oil for Killing the Pupæ.—The results obtained from the use of the distillate emulsions and kerosene-oil emulsions, following the spring use of the I X L compound, indicate a considerable saving over the loss that would have resulted from depending upon that compound. That this result would have been quite as good had the I X L compound spraying been omitted, seems more than probable, when we remember that the bud-worm attack was so severe on the place that it appeared at the time that this material had in nowise controlled the pests in this stage. The results of this work with the distillate and kerosene emulsions were certainly good enough to warrant their use, and will be useful to fruit-growers in the future, if by any chance they fail to spray at the proper time, and find that the worms are pupating in too great numbers on the trunks and larger limbs of the trees, as is their habit in the spring generation.

LOSS WHEN SPRAYED IN MARCH WITH I X L COMPOUND, AND IN MAY WITH EMULSIONS OF DISTILLATE AND OF KEROSENE.

Variety.	No. of Trees.	Maximum per cent.	Minimum per cent.	Average per cent.
Alexander	300	8	6	7
Hale	250	25	20	21
Foster	200	20	20	20
Levi	350	12	10	11
Salway	560	18	18	18
Total	1,460	25	6	15

Winter Spraying with Lime, Salt and Sulfur.—When compared with the loss where no spraying has been the practice, the winter use of the lime, salt and sulfur, as shown on orchard No. 1, results in a certain amount of control of the worm. The results are by no means satisfactory, for while a great deal better than either of the treatments given above, still the work does not result in the reduction of the loss to a low enough minimum.

LOSS WHEN SPRAYED IN WINTER WITH LIME, SALT AND SULFUR.

Variety.	No. of Trees.	Maximum per cent.	Minimum per cent.	Average per cent.
Alexander	110	20	20	20
Hale	220	25	25	25
Early Crawford	300	18	18	18
Susquehanna	200	25	25	25
McDevitt	150	25	25	25
Levi	330	25	25	25
Salway	350	25	25	25
Total	1,660	25	18	24

Spring Spraying with Lime, Salt and Sulfur.—The best results were obtained by the use of lime, salt and sulfur compound, as shown by the following table:

LOSS WHEN SPRAYED IN SPRING WITH LIME, SALT AND SULFUR.

Variety.	No. of Trees.	Maximum per cent.	Minimum per cent.	Average per cent.
Alexander	1,195	15	0	4
Hale	4,175	15	0	5
Early Crawford	2,285	15	0	5
St. John and Imperial	1,400	2	0	1
Susquehanna	1,325	15	1	3
Foster	1,950	9	1	4
McDevitt	2,230	18	1	6
Levi	3,800	12	0	3
Salway	4,300	5	1	2
Total	22,660	18	0	3

In some respects the above table fails to give a correct idea of the results from the use of this mixture at the right time, since it includes two orchards, station C and orchard No. 10, in which the conditions were very unfavorable for producing good results. With these two orchards eliminated, the average amount of injury shown by the tables would not be over one per cent. Even when they are included the efficiency of this treatment as compared with the others is very strikingly shown in the following table:

COMPARATIVE STATEMENT OF LOSS BY DIFFERENT TREATMENTS.

Spraying Material.	No. of Trees.	Maximum per cent.	Minimum per cent.	Average per cent.
Not sprayed	4,884	65	25	48
I X L compound	7,100	70	20	50
I X L compound and distillate	1,460	25	6	15
Winter lime, salt and sulfur	1,660	25	18	24
Spring lime, salt and sulphur	22,660	18	0	3

MISCELLANEOUS RESULTS.

Loss Due to Adjacent Infested Orchards.—The results obtained at station C show plainly the danger from careless neighbors. The location of this station is in a district where spraying is not the rule, and where the loss from wormy fruit is usually very heavy. When the place was selected for these experiments it was found to be well stocked with hibernating larvæ. The orchard had been sprayed the previous year with the lime, salt and sulfur compound. The loss of fruit last year was reported to us as being "very heavy."

Spraying operations were begun in this orchard when the buds had swollen and were nearly ready to burst out. The lime, salt and sulfur compound was prepared by the owner with great care and the trees thoroughly treated. While the material used and the method and time of application were in accordance with the best practice, yet when the crop was picked it was found that there was a heavy loss from wormy fruit.

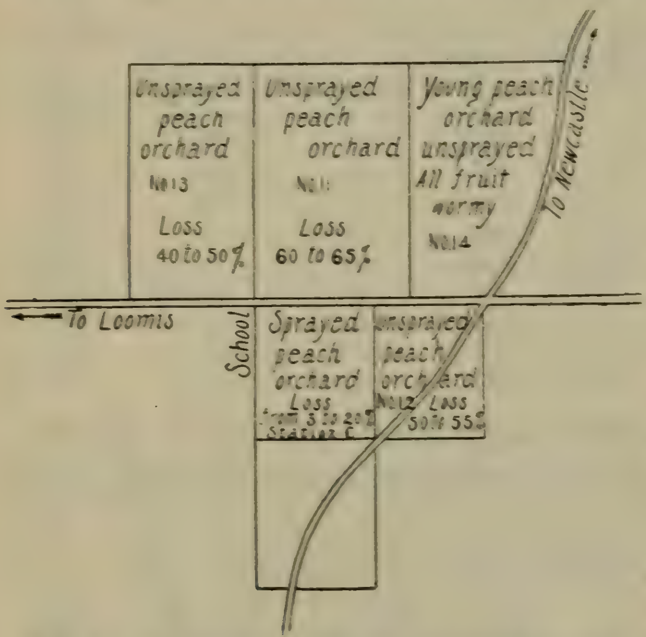


FIG. 15. Loss caused by adjacent unsprayed orchard.

The location of this orchard and the relative losses here and in neighboring orchards are shown in Fig. 15. The loss in the sprayed place is very much less, as will be noted, than in the unsprayed orchards, though it is much greater than in the orchards more favorably located as to neighbors.

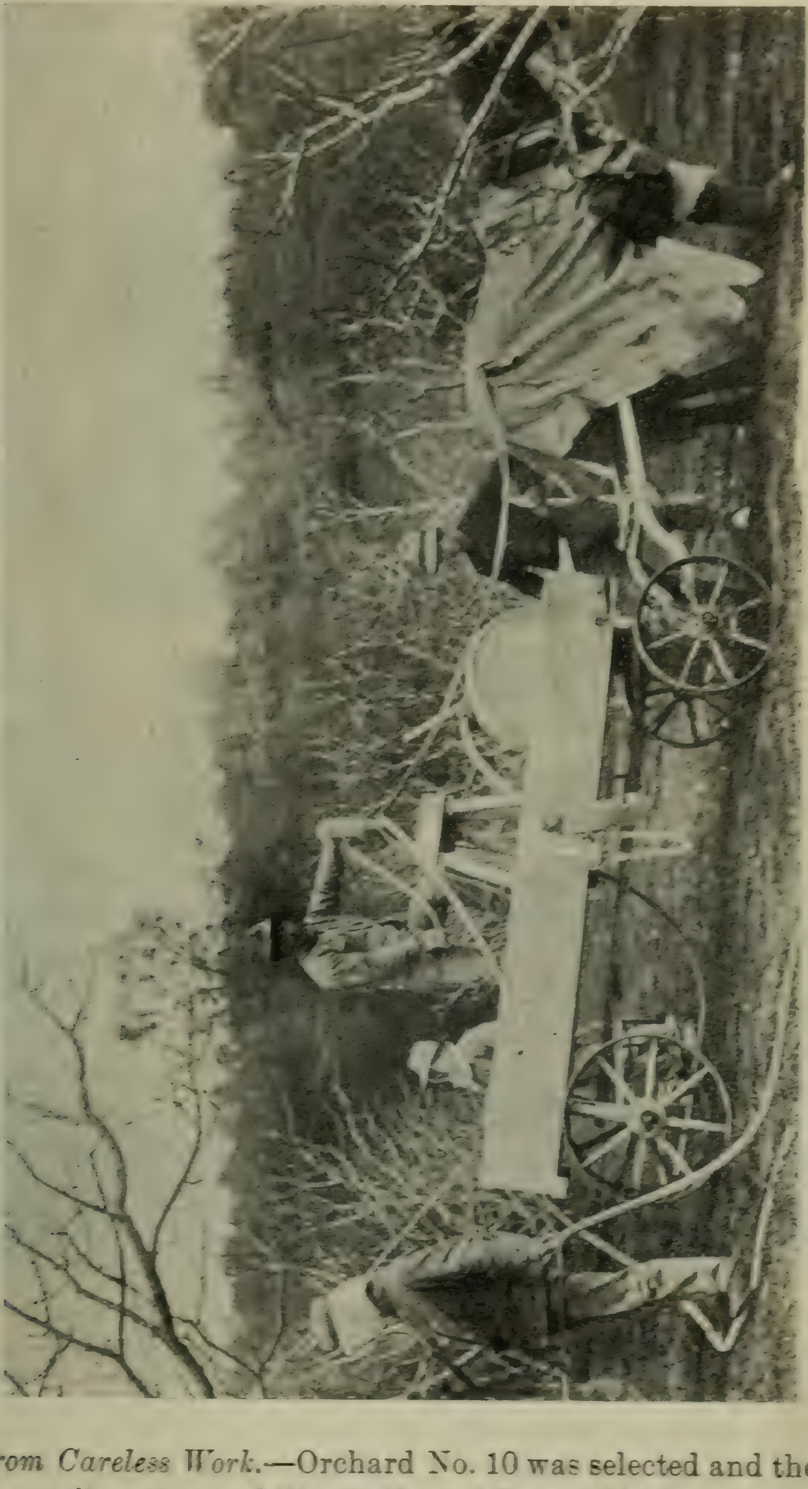


FIG. 16. SPRAYING OUTFIT IN USE AT STATION A.

Loss from Careless Work.—Orchard No. 10 was selected and the records kept because it was a good illustration of the results of carelessly spraying the trees. This orchard was worked by Chinese renters under a lease requiring them to spray the place each year. The work was done, however, in the most perfunctory manner. We visited the place a number of times while spraying was under way, and gave the matter careful attention. The lime, salt and sulfur mixture was used, but was made up in a way that rendered it practically useless. All of the materials, except the water, were being used in reduced quantities, and the mixture was scarcely, or not all, boiled. The loss found here can be directly traced to this carelessness. This orchard No. 10 lies next to the station A, on which the loss was very small.

The tables will show the loss sustained in orchard No. 10 to be considerable, but it would not have been strange, when the method of spraying is taken into account, if it had been still greater.

Saving by Careful Work.—As a contrast to these last two places, we may cite the orchard we have called station A. The owners of this orchard had suffered a heavy loss the previous year from wormy fruit. The trees were found much infested with the hibernating larvæ when inspected in January. We were able to have the work of spraying done in the most careful manner on this place. Fig. 16 shows one of the spraying outfits used at this place.

The contrast between this orchard and orchard No. 10 was very striking. As previously noted, these two orchards lie adjacent to each other. On three rows of Hales next to the poorly-sprayed place the loss was from five to ten times greater than the loss in the orchard as a whole. Without doubt this was due to the flight of the moths from orchard No. 10. Similar instances were noted in several cases.

The Use of Oil and Distillate Emulsion.—A small number of experiments not noted in the above tables indicate that the emulsions of kerosene and the distillate oils, when used in the early spring, produced a good degree of control, though hardly as good as when the lime, salt and sulfur were used under identical conditions. Experiments with these materials are to be conducted, however, on a commercial scale, in order to demonstrate their real value for spring-spraying purposes.

The value of these substances, as used against the pupæ of the first generation, is clearly shown. It should not be made the sole dependence, but rather to enable the grower to have another chance at killing the insect, when for any cause the first, or spring, spraying has been omitted or found ineffective. This treatment should be so timed in the late spring that pupation will be well under way, as determined by careful inspection of the trees at that time.

The distillate oils are prepared in emulsions by certain manufacturers, and are quite cheap and effective. The oils themselves are quite readily emulsified. We have found the following formula useful:

Distillate oil (28° or 32°-35°)	5 gallons.
Common kitchen soap	4 to 6 pounds

Dissolve the soap in about four gallons of hot water. Pour the oil into the hot suds, and thoroughly churn the two together by pumping the material back into itself through a spray pump. In from ten to fifteen minutes the material will be thoroughly emulsified, and will be of a creamy color and consistency. In this condition it readily mixes with water. To use, dilute in the proportion of one of emulsion to eight of water, using hot water preferably. Apply to the trees warm.

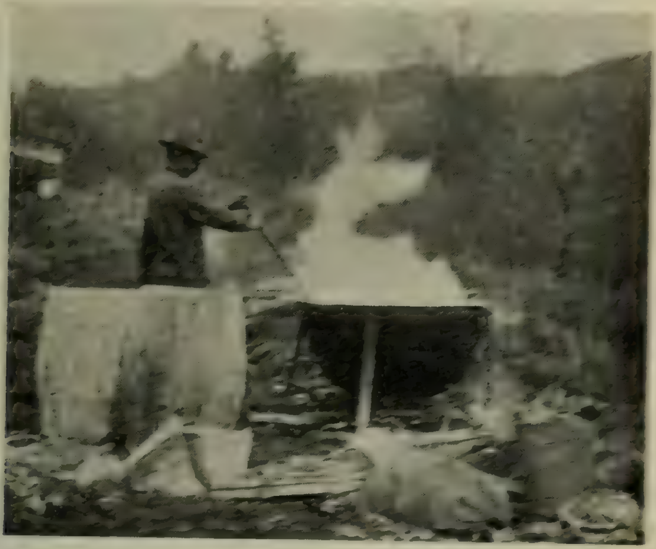


FIG. 17. Boiling the lime, salt and sulfur spray.

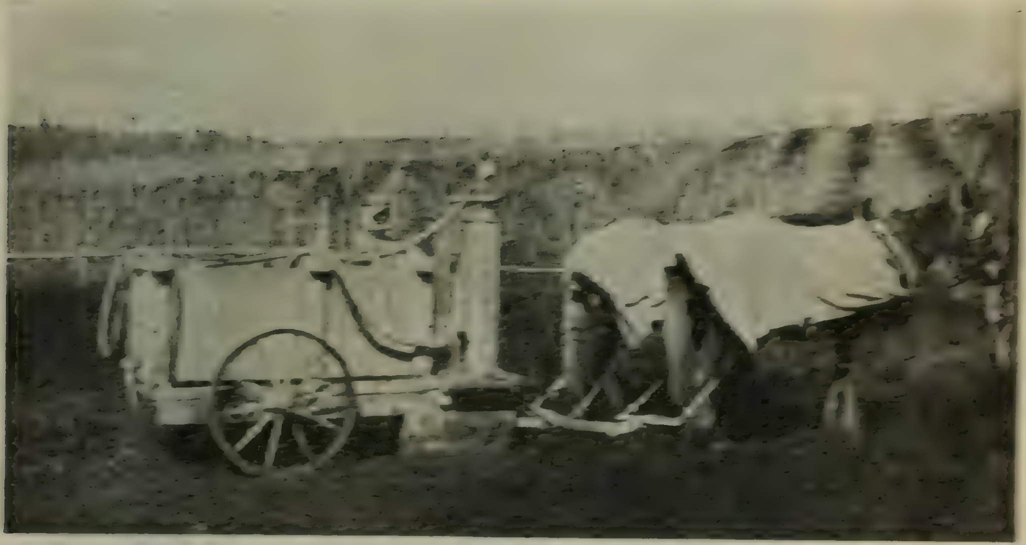


FIG. 18. Wheeled sled and tank spraying outfit.

The kerosene-oil emulsion may be prepared in the same way, but using no more than four pounds of soap. It is to be used in the same way as the distillate emulsion, but is not quite as effective as the latter.

GENERAL CONCLUSIONS AND RECOMMENDATIONS.

The experiments reported in this bulletin prove that the peach-worm can be controlled by the use of the lime, salt and sulfur compound, if this material is prepared in the proper manner and thoroughly applied at the right time. These three factors are all essential to successful treatment.

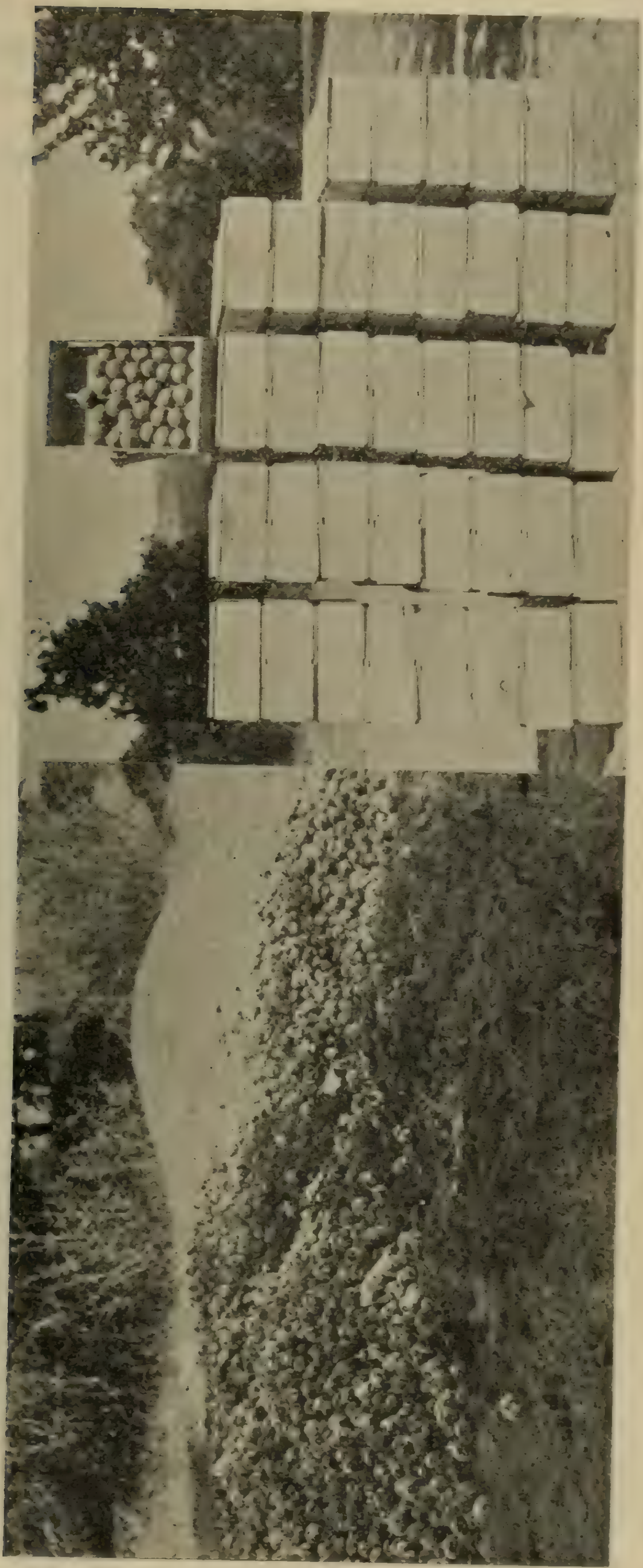
The formula for the preparation of the lime, salt and sulfur spray, as used successfully in the Placer County region this season, is as follows:

Lime	40 pounds.
Sulfur	20 pounds.
Salt	15 pounds.
Water, to make	60 gallons.

Boil 10 pounds of lime and 20 pounds of sulfur in 20 gallons of water for from one and one half to two hours, or until the mixture is a deep amber color, which will indicate that the sulfur is dissolved. The balance of the lime, 30 pounds, should then be slaked in another vessel and the salt added to this latter mixture. This should be stirred until the salt is dissolved and then added to the original mixture of lime and sulfur, and the whole boiled for from thirty to forty-five minutes longer, enough water being added to bring the total amount of material up to 60 gallons. Next strain the material into the spray tank and apply to the trees *hot*. Do not let the material get cold, for a portion of the ingredients will then crystallize and precipitate out of the liquid, and its effectiveness is much reduced. Many different arrangements for boiling the spray are used, and each orchardist will devise the method most convenient to him. We found the device shown in Fig. 17 a convenient arrangement. In this case a large iron cauldron was set up on an iron frame, so made that the bottom of the cauldron was about one foot above the ground, when the device was ready for use. A fire could then be easily built beneath the cauldron and the boiling thoroughly done. When it is not necessary to move the cauldron, it is well to build up a stone or brick fireplace beneath it, so arranged that a good draft can be maintained.

As to the apparatus for spraying, one may employ any of the outfits of pumps, etc., commonly sold for use in orchards. Two such outfits are shown in Figs. 16 and 18, from photographs taken in the orchards this spring.

The important thing in spraying work is to completely cover every tree with the material used. This thorough work must be insisted on as a requisite for successful control of the worm. The hibernating burrows in which the worms are hiding at this season may be found in any part of the tree—from the tips of the topmost branches to the ground.



From unsprayed orchard having seventy five per cent loss.

From well-sprayed orchard having less than one per cent loss.

FIG. 19. SHOWING TWO WAYS OF DISPOSING OF THE CROP.

The *time to make the application* varies with the variety. It should be done when the buds have begun to swell perceptibly, and it may be delayed, without serious injury to the tree, until after the blossoms have begun to appear, at least under the conditions found in Placer County during the past season.

The effectiveness of such treatment can now be considered to be an established fact.

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